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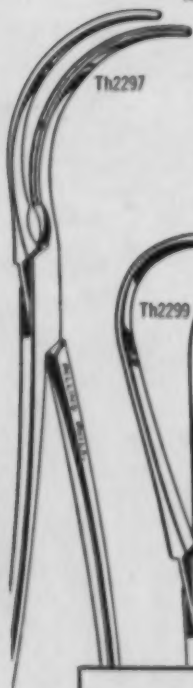
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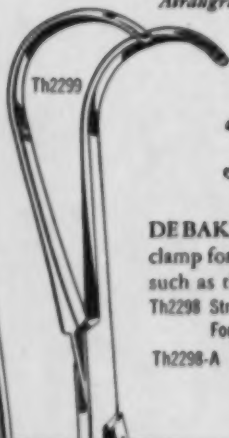
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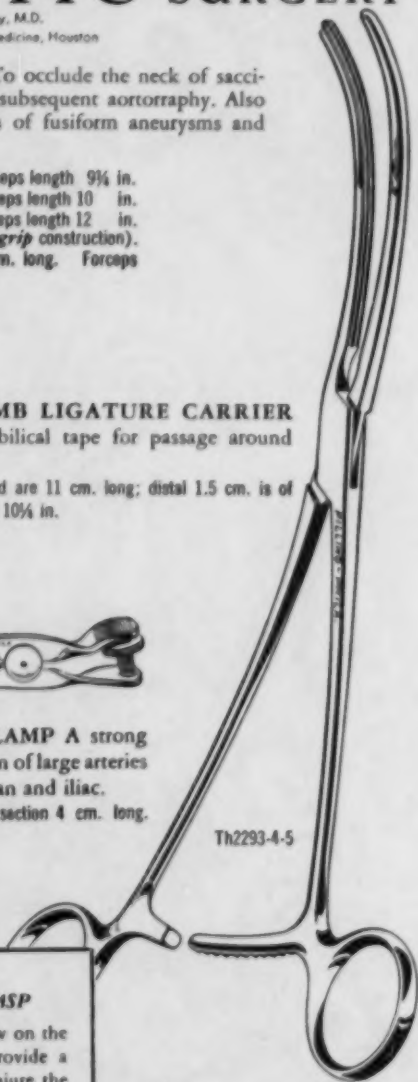
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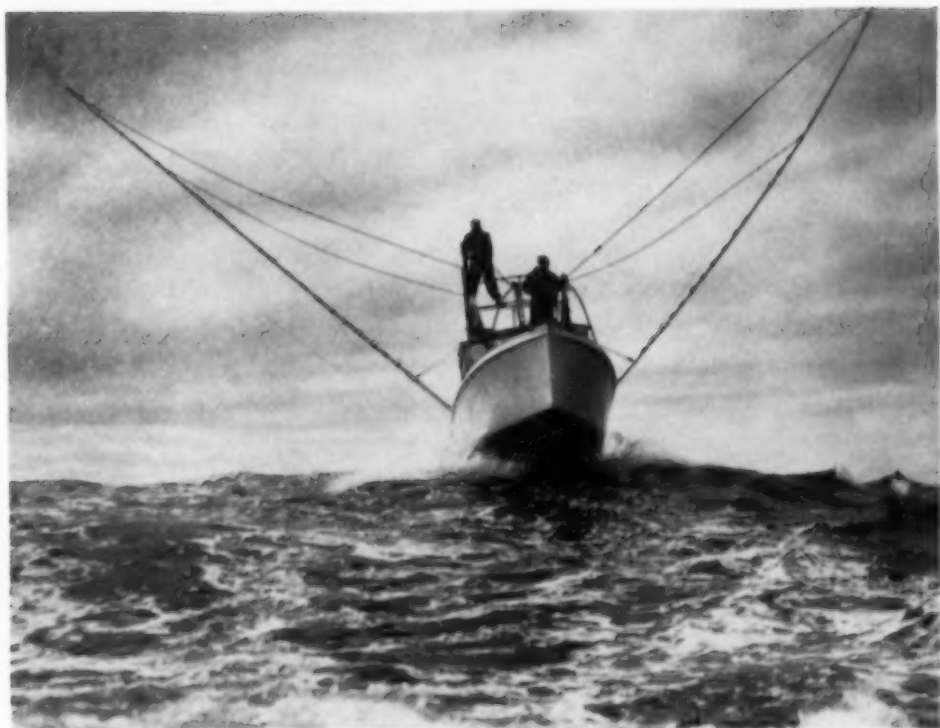
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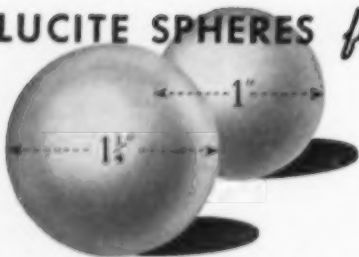
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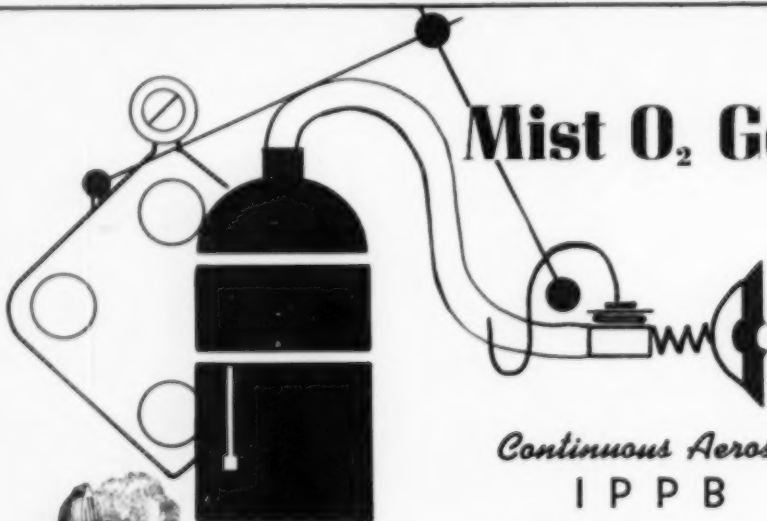
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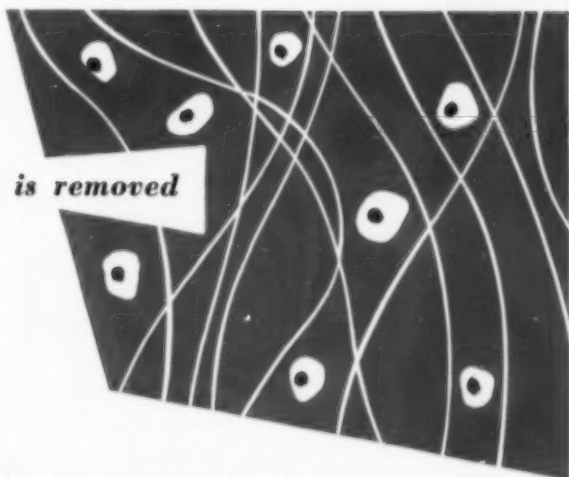
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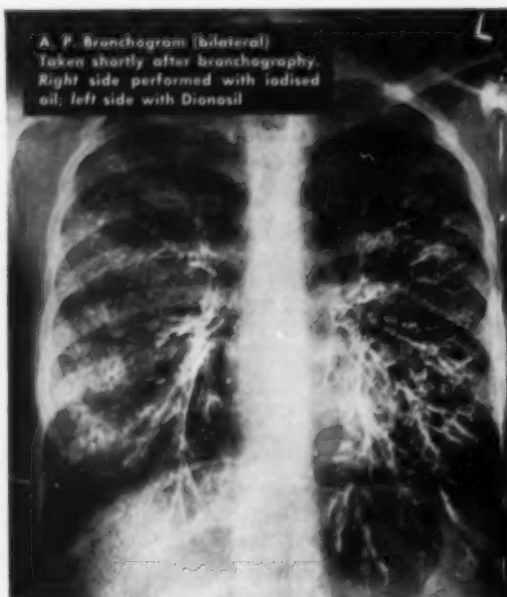
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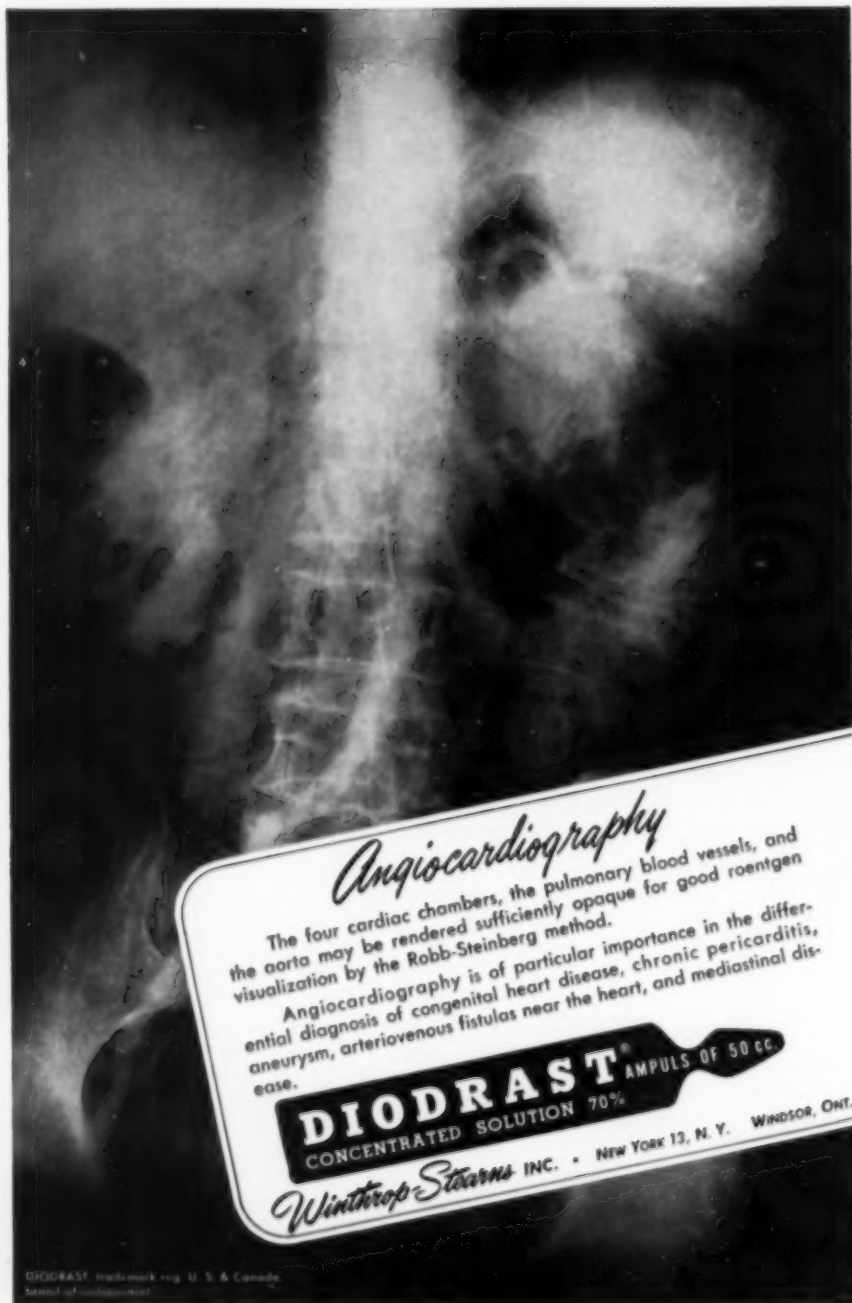
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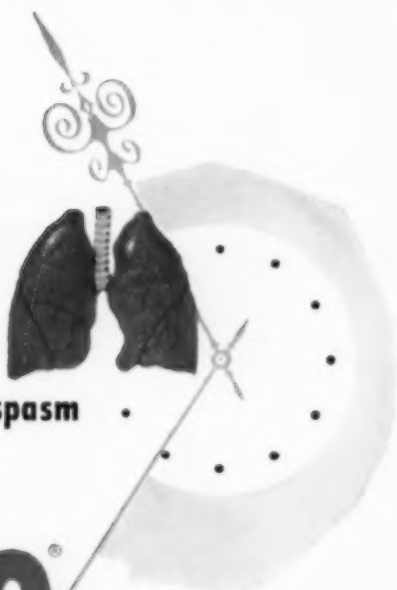
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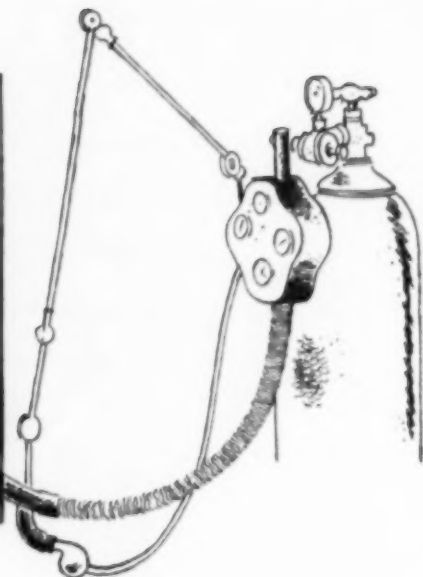
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1. Tidwell, R.A.: Northwest Med. 53:470 (May) 1954.
2. Tidwell, R.A.: Read before Annual Meeting of A.M.A., San Francisco, June 24, 1954.



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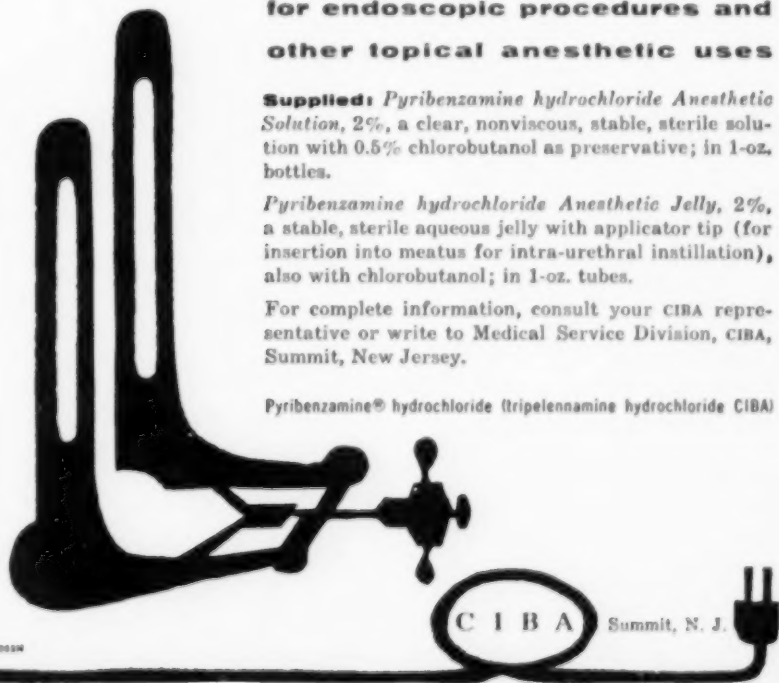
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Singer, J. J.: *Differential Diagnosis of Chest Diseases*. Philadelphia, Lea & Febiger, 1949, pp. 1953-4.

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Clinical Experience with Pneumoperitoneum in the Treatment of So-Called Hypertrophic Emphysema*

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The word "emphysema," taken from the Greek, means inflation. The term pulmonary emphysema has been clarified by so many workers that we are now in a state of utter confusion. To recall a few of the adjectives which have been used to modify pulmonary emphysema we shall mention: alveolar, diffuse vesicular, dystrophic, essential, genuine, hypertrophic, hypoxic, idiopathic, and obstructive. It is known as chronic large lung, pulmonary dilatation, pulmonary hypertrophy, and pneumonectasis. We believe PSEUDOHYPERTROPHIC EMPHYSEMA or SO-CALLED HYPERTROPHIC EMPHYSEMA are more descriptive terms, for the increase in the volume of the lung is not due to augmented cellular or tissue structure. On the contrary, there is an extensive degenerative process with loss of elastic fibers and destruction of alveoli.

From a clinical point of view it is well to differentiate between pseudohypertrophic emphysema and senile emphysema. The distinguishing features of these entities were described by one of us¹ in the January 1954 issue of *Diseases Of The Chest*.

With the increasing use of mass chest surveys many patients are recognized with pulmonary emphysema. It is desirable to diagnose the existence of emphysema early for the sooner the treatment is begun the more hopeful is the prognosis. However, it would not be expedient to apply the same kind of therapy to patients with senile and pseudohypertrophic emphysema.

Simple clinical observation is often adequate to diagnose so-called hypertrophic pulmonary emphysema. It occurs predominately in men. It is a slowly progressing disease. These patients become dyspnoeic with slight exertion. Many find dyspnoea relieved with pursed lip expiration. They are cyanotic and are observed to have increased venous pressure by watching the fullness of the jugular veins as well as the arm veins even when in the erect or semirecumbent position.

Many of these patients have clubbed fingers, hippocratic incurvation of the nails, and decreased or absent lunulae of the nails. We described the

*Presented at the 20th Annual Meeting, American College of Chest Physicians, San Francisco, California, June 17-20, 1954.

occurrence of acroerythrosis and palmar erythema in these patients as well as in others with chronic pulmonary disease.²

The patient may sit leaning forward with his hands on his knees supporting his shoulders.

Most patients suffer some degree of cough depending upon the type and extent of coexisting bronchitis, pulmonary fibrosis, or heart failure.

Abdominal pain may result from cardiac decompensation with hepatomegaly or anoxia of the diaphragm which we call "diaphragmatic angina."

Wheezing is common. It results from bronchospasm or inflammatory exudate in the bronchi or both.

The antero-posterior diameter of the chest is increased producing the characteristic "barrel chest" configuration. Protrusion of the epigastrium during inspiration is decreased or absent.

Teleoroentgenograms should be taken in postero anterior and lateral positions both in inspiration and expiration. The patient should be examined fluoroscopically. One observes:

- 1) Enlarged lung fields,
- 2) Increased radiotranslucency of the lung fields,
- 3) Dorsal kyphosis,
- 4) Horizontal position of the ribs,
- 5) Widened intercostal spaces,
- 6) Enlarged anterior and posterior mediastinal spaces,
- 7) Small cardiac silhouette,
- 8) Widened costophrenic sulci,
- 9) Diaphragm low, decreased convexity, or both,
- 10) Diaphragmatic respiratory excursions decreased or absent,
- 11) Fluoroscopically, paradoxical motion of diaphragmatic segments.

As a simple office procedure we have found that while a normal individual is able to exhale the entire volume of his inspiratory and expiratory reserve air in two or three seconds, patients with so-called hypertrophic emphysema require eight to 14 seconds to complete this maneuver.

To approach the treatment of pulmonary emphysema rationally it will be well to review the alterations in the normal physiological status of the lung. One finds pulmonary insufficiency and circulatory disturbances.

In this type of emphysema pulmonary insufficiency is due to destruction of elastic fibers, distention and rupture of many alveoli, compression of bronchioles and alveoli by bullae, downward displacement and loss of function of the diaphragm. Decrease in pulmonary ventilation is aggravated by distention of the chest wall. The function of the normal muscles of inspiration and expiration is diminished. One may observe excessive use of the accessory muscles of inspiration.

Pulmonary insufficiency is associated with faulty distribution of inhaled air. The alveolar ducts become dilated and lose their jet-like effect normally imparted to inspired air. With loss of pulmonary elasticity the emphysematous lung is unevenly ventilated. Anatomically intact alveoli with normal capillary blood supply receive only a portion of the air current. Some of the inspired air is deviated to the emphysematous alveoli, blebs, and bullae.

Such faulty distribution of inspired air is augmented by spasm of the bronchioles.

One cannot hope to restore destroyed alveoli. We believe we are able, however, to improve the function of the alveoli which still retain some elastic fibers and capillaries.

We feel that something is accomplished through the use of the following agents:

Digitalis is prescribed for patients in heart failure.

Aminophyllin is used for its influence on the heart as well as for its broncho-relaxing effect.

An anticholinergic agent is employed. The lung and gut are derived from the same embryonic stem. The bronchi and intestine react in like manner. Diethyl methyl ammonium bromide relaxes bronchospasm. It does not produce the drying effect so common with atropine derivatives.

Of the sympathomimetic drugs we use isopropyl epinephrine either as a sublingual tablet or applied as a nebulum.

When bronchial infections occur it is necessary to institute appropriate antimicrobial therapy without delay.

We have found pneumoperitoneum the most effective procedure to restore the function of the diaphragm and thus to improve pulmonary ventilation in patients with pseudohypertrophic pulmonary emphysema.

Pneumoperitoneum is a simple and safe procedure which can be induced and maintained in an office or clinic. Patients who are very ill may be admitted to a hospital for the initial treatment and the first few refills. It is not unusual for patients to be brought to the treatment room in a wheel chair and find that after the initial pneumoperitoneum they are able to walk away without assistance.

Patients should be examined fluoroscopically before each treatment.

For the initial treatment any site on the anterior wall of the abdomen may be selected. One should avoid areas of previous abdominal surgery. We prefer a location three fingerbreadths below or above and to the left or right of the umbilicus. After the pneumoperitoneum is well established one may use a site over an area of maximum collection of air in the peritoneal cavity. This is determined when the patient is examined fluoroscopically before each refill. Thus a point under the costal arch may be chosen, or if the patient lies on either side, the needle may be inserted above the 11th rib. Great caution must be exercised as the pleura normally reflects at the 10th rib laterally. It is possible that some of the instances of air embolism reported in pneumoperitoneum may be due to accidental puncture of the lung when the low intercostal site is chosen. Dasher, Black, Weiss, and Bogen³ state that air embolism will be least likely to occur if one selects a site below the umbilicus and preferably in the left lower abdominal quadrant.

We use 1 percent procaine to infiltrate the skin and peritoneum both for the initial and for subsequent treatments. Some patients request that local anesthesia be omitted.

The site selected is prepared with a surgical antiseptic solution; sterile drapes are applied; a 19 gauge two and a half inch, long bevel needle is attached to a three way stopcock. The sterile rubber tube is connected between the three way stopcock and a standard Robinson pneumo apparatus.

The needle is pressed slowly and gently through the abdominal wall perpendicular to the skin surface. As it passes through the tissues one may feel the resistance offered by the layers of the abdominal wall.

When the point of the needle is in the abdominal cavity one must draw back on the piston of the syringe attached to the upper aperture of the three way stopcock, being sure the valve is so placed that the needle and syringe are connected. In this manner one ascertains that the point of the needle is not in a blood vessel. If no blood is obtained, 25 cc. of air or less is injected from the pneumo apparatus. The flow of air may be permitted by force of gravity or it may be introduced under low positive pressure. If the point of the needle is not in the peritoneal space but in the abdominal wall, air will flow very slowly and the manometer will indicate a non-oscillating positive pressure of 12 to 24 cm. of water. If such is the case the needle is slowly advanced and the above maneuver is repeated. When air is injected into the peritoneal space a moderately low positive pressure will be observed.

We have found it best to introduce 50 cc. of air at a time, testing for sudden increase of intraperitoneal pressure as well as drawing back on the piston of the syringe before proceeding with the next introduction of air. We believe this reduces the pain associated with stretching of peritoneum and prevents air embolism.

The total amount of air administered with the initial treatment is 500 to 600 cc.

If the pneumoperitoneum is satisfactory one may elicit tympany over the liver in place of the normal dullness. When the patient rises from the table after the initial treatment he usually notices shoulder pain from pressure of the injected air upon the diaphragm.

Refills of 500 to 600 cc. of air are given at weekly intervals.

In our clinic we use a simple modification of the Robinson pneumo apparatus for the administration of pneumoperitoneum. The standard apparatus is supplied with a length of rubber tubing which reaches from the number one flask to the control valves. When air in the number one flask is exhausted it is necessary to reverse the position of the number one and number two flasks and allow the fluid to siphon back into the number two flask.

We replaced the above mentioned tubing with one long enough to reach from the control valves to both flasks in either the elevated or lowered positions. We applied a Luer tubing adapter to the end which connects with the flasks. Thus when the air in the number one flask becomes exhausted we reverse the position of the flasks and change the tubing connection so air is now delivered into the peritoneal space from the number two flask.

This modification offers the following advantages:

- 1) It saves the time required to refill the number two flask.
- 2) It provides a more logical use of the air filter. With the standard apparatus when the number one flask is recharged with air, any foreign matter in room air is deposited on the outside of the filter. This may be blown into the peritoneal space when the pneumoperitoneum is given. With our modification, since air always flows in one outward direction any foreign matter is caught by the filter and retained in the mesh.
- 3) It conserves the energy of the nurse who assists with the treatments.

Large amounts of air are necessary to relax the lung when pneumoperitoneum is used for the treatment of pulmonary tuberculosis. We have found, however, that relatively small amounts of air are more beneficial in the treatment of emphysema. In our early experience we found that the diaphragm became more mobile with small amounts of air. When the volume of pneumoperitoneum was increased the diaphragm lost some of its motion. Our patients complained of abdominal discomfort and increased dyspnoea when the amount of air exceeded an optimal quantity. Beck, Eastlake, and Barach⁴ presented their studies of venous pressure and pneumoperitoneum before this College. They showed tracings of venous pressure which was initially elevated, became lower with the introduction of pneumoperitoneum, and again became elevated when the volume of pneumoperitoneum was increased beyond a critical level.

The patient is encouraged to wear a well fitting abdominal support. In this manner a smaller amount of air may accomplish the desired therapeutic result.

We have continued therapeutic pneumoperitoneum for years. It is difficult to determine the proper duration of treatment and each patient must be considered individually.

One patient discontinued therapy because he suffered an attack of acute appendicitis. Following appendectomy and interruption of pneumoperitoneum, his dyspnoea and cyanosis became severe. It was necessary to reestablish the treatment two weeks after appendectomy. It has been maintained since.

Another patient was completely disabled with emphysema. With pneumoperitoneum he was able to return to full time employment. One night he suffered acute intestinal intussusception requiring emergency surgery. Following this surgery the patient continued well without pneumoperitoneum. We believe that if sufficient muscle tissue remains in the diaphragm and if diaphragmatic function can be reestablished one may facilitate some muscle eutrophy. In such instances patients may be able to abandon pneumoperitoneum after a period of time. On the other hand, if the diaphragmatic muscle has suffered such atrophy of disuse that muscle eutrophy does not occur, then pneumoperitoneum may have to be maintained indefinitely.

One may anticipate most relief when the entire diaphragm is mobilized. We have observed marked symptomatic relief however when one leaf of

the diaphragm remains fixed by adhesions and the other leaf is mobilized with pneumoperitoneum. These patients may complain of abdominal pain due to stretching of adhesions especially after a refill. Such pain is partially relieved by salicylates. Most patients enjoy enough relief of respiratory distress to disregard the abdominal discomfort.

We believe a comment relative to one of our patients is pertinent. He was returned to his family physician from a large clinic with the diagnosis of: 1) PULMONARY EMPHYSEMA, and 2) MENTAL DEPRESSION. Psychiatric treatment was recommended. Curiously, one of us arrived to examine him in the hospital at the same time as the psychiatrist. The patient was truly depressed. He was totally disabled. He was about to lose his job. He couldn't walk five feet from his bed to the wash room without dyspnea and cyanosis.

The psychiatrist recommended shock therapy to improve the mental depression. He agreed, however, to postpone it until we could try pneumoperitoneum treatment to improve the pulmonary ventilation.

This is the patient we mentioned before who was able to discontinue pneumoperitoneum treatment after six months of therapy and who now works full time without pneumoperitoneum. It is now a year since he has received pneumoperitoneum. He was examined fluoroscopically a few weeks ago. The diaphragm which had been depressed and immobile with respiration before pneumoperitoneum still retained the mobility which was observed during the therapy.

We should like to submit the brief that therapeutically pulmonary emphysema stands in the relative position today which was occupied by pulmonary tuberculosis 25 years ago. If we can diagnose and treat these patients in the early stages of the disease we believe they will not become the desperate respiratory cripples who are now encountered.

CONCLUSIONS

There is no consensus relative to the etiology of pseudohypertrophic pulmonary emphysema. It should be differentiated from other forms of pulmonary emphysema—particularly senile emphysema which is an involutional condition. One of the cardinal features of pseudohypertrophic pulmonary emphysema is the low position of the diaphragm and functional diaphragmatic insufficiency. Artificial pneumoperitoneum aims at restoring the normal anatomic and physiologic status of the diaphragm.

Pneumoperitoneum in itself does not represent the complete management of the patient with emphysema. It is necessary to correct circulatory and bronchial disturbances which are part of the disease.

In our practice this program has been found a safe and useful method of treatment of patients who suffer with emphysema. Its use is followed by gratifying subjective and objective results in the great majority of individuals.

RESUMEN

No hay un acuerdo respecto de la etiología del enfisema pulmonar pseudohipertrófico. Este debe diferenciarse de las otras formas del enfisema

pulmonar, en particular el enfisema senil que es una condición de involución. Una de las características cardinales del enfisema-seudohipertrófico es la posición baja del diafragma y la insuficiencia diafragmática. El neumoperitoneo artificial tiende a restaurar la situación anatómica y fisiológica del diafragma.

El neumoperitoneo por sí no representa el tratamiento completo del enfermo con enfisema. Es necesario para corregir los trastornos circulatorios y bronquiales que forman parte de la enfermedad.

En nuestra práctica este plan es encontrado seguro y útil para el tratamiento del enfisema. Su uso es seguido de resultados satisfactorios tanto subjetivos como objetivos en la gran mayoría de los sujetos.

RESUME

L'accord général n'est pas fait sur l'étiologie de l'emphysème pulmonaire pseudohypertrophique. Il semble qu'il y ait une différence entre cette forme et les autres catégories d'emphysème pulmonaire, et en particulier l'emphysème sénile, qui représente un caractère involutif. Un des éléments essentiels de l'emphysème pulmonaire pseudohypertrophique est la situation basse du diaphragme et l'insuffisance fonctionnelle de ce muscle. Le but que l'on se propose avec le pneumopéritoine artificiel est précisément la restauration de l'état anatomique et physiologique normal du diaphragme.

Le pneumopéritoine ne représente pas à lui seul tout ce que l'on doit faire pour traiter l'emphysémateux. Il faut de toute nécessité corriger les troubles circulatoires et bronchiques qui représentent une partie de la maladie.

Dans la pratique des auteurs, l'application d'un tel programme a permis des résultats certains et favorables chez les emphysémateux. La conséquence en a été une amélioration subjective et objective pour la grande majorité des malades.

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The Los Angeles X-Ray Survey Film and Record Library, Its Past Development, Present Activities and Future Possibilities

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The nearly 2,000,000 microfilms and 55,000 large films taken during the Los Angeles X-Ray Survey of 1950 together with the records of the data available regarding them constitute a unique mass of source material which is invaluable for both practical and scientific purposes. The \$200,000 contributed by the County Government, and more than \$1,000,000 expended by the Public Health Service and local agencies in this survey, as well as the contribution of time and materials by thousands of citizens have already been more than repaid by the decrease in sickness and death from tuberculosis which has already followed the survey. Still greater harvest, however, remains to be reaped through the maintenance of the library and its continued utilization.

In the absence of long range planning for the preservation and maintenance of the survey films and records, the developing demands for this material were met during and after the completion of the survey by the Survey Foundation and its staff. Then the Los Angeles Tuberculosis and Health Association provided for the cost of continuation of the library, which was moved in May 1952 to the northeast portion of the main floor of the old psychopathic building of the Los Angeles General Hospital, and on July 1, 1953, the entire support of the library was assumed by the County Government, and it is hoped that this arrangement may be continued.

Three monographs, *The Big Picture*, published July 1951, a statistical study, *Report of Confirmatory Chest X-ray Film Findings Indicative of Tuberculosis*, published in June 1952, and *A Statistical Analysis and Review*, by G. J. Drolet in May 1953, have presented the chief findings made available during the survey itself and the immediate follow-up. Many other studies, however, are now under way and may be carried on in the future with this material, which may even be more important.

As a preliminary to the statistical analysis of the survey material, a census tract index of all addresses in the entire county was prepared. Copies of this index have been available to the County Government and are already being utilized in several different departments, some of which, as the Probation Department, had already spent much time and effort in attempting to prepare such an index of their own previously; and in 1954 these census tract indices were utilized in the Interim Census of Los Angeles.

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Records of all of the individuals participating in the survey were then assigned to census tracts and tabulation made of the age, sex and race distribution of the positives and negatives for each census tract. Information regarding the incidence of tuberculosis in different areas of the county have been thus made available to the Health Departments. Additional studies of the geographical distribution of the population and of the disease are now under way which may shed further light on where and how case-finding activities should be planned in the future. Thus, for example, it has been shown that an x-ray unit placed in a jail will yield more than 100 times the proportion of cases of tuberculosis than one placed in a high school, and that a unit taking only 100 films a day in some areas of the city would find many more cases than one which took 1000 films a day in another—Main Street or Central Avenue as compared with Beverly Hills or Westwood.

Further studies of ecological mobility, the pattern of travel and tendency to go out of the local neighborhood for the x-ray examination may further increase our knowledge. The scores of different ways in which the county has been divided geographically for various purposes has also been investigated, and the result of this study should constitute a useful contribution to city planning and statistical study of many kinds and even to further governmental boundary fixing.

A duplicate set of records of old films has been arranged alphabetically. Alphabetic arrangement of nearly 2,000,000 cards has represented an investment of approximately \$20,000, or about 1¢ per card, and is one of the largest projects of this kind known, being many times that involved in any available telephone directory or street or city directories known. Now that this alphabetizing has been completed, however, it discloses many facts and makes possible other investigations which were previously not available. Thus the study now under way has shown that over 60,000 people had more than one film taken during the survey, and comparisons of the findings of these repeat films on the same individual have given valuable information regarding the reliability of the readings of the films as well as regarding the development of tuberculosis in short periods of time.

The alphabetic arrangement has also made possible checking the survey population against the newly reported cases of tuberculosis and deaths from tuberculosis in the county. This has shown how often persons who received a negative report in the film in the survey taken in 1950 have since developed the disease and succumbed from it during the first, second or third year which has elapsed since the films were taken. Additional information regarding the misinterpretation of lesions which were present at that time but not recognized on the film should lead to improvement in the examination and interpretation of minifilms in the future.

There are at present nearly as many case-finding units operating in the Los Angeles County as were utilized during the survey, especially in the various hospital admission programs, Health Departments and other agencies, although few of them take anything like as many films

in a day as were taken during the survey. Improvements in the conduct of these many case-finding units, however, may greatly increase the value, both in finding cases which might otherwise be missed, and also in preventing the arousing of unfounded suspicions.

Extensive clinical material represented by these 2,000,000 films is of great value in a large variety of anthropometric, anatomic and physiologic, as well as medical studies. Thus the 200 instances of dextrocardia in this series, the largest ever made available, have been analyzed from many points of view, and nearly 100 of the persons concerned have voluntarily returned for further x-ray and electrocardiographic study which have shown great light on the origin and especially on the clinical significance of this condition. A study of the age incidence of cases of scoliosis shown in the survey would be of particular orthopedic interest and may aid in the recognition of etiologic factors in this condition. A large number of studies regarding cancer and heart disease have already been presented, and many more are possible on the basis of the material contained in these records.

Originally it was expected that the film library would be required chiefly during and immediately following the survey and thereafter that the films might well be, as done in most other places, distributed to the various health departments or even destroyed. The time which has elapsed since the survey, however, has shown that this would indeed be a tragedy, and would lose some of the greatest potentialities for good in the survey. Every year, the development of new instances of tuberculosis, cancer and heart diseases makes possible further study of the value of the survey in disclosing and predicting the occurrence of such conditions. In fact it may well be expected that the final evaluation of the significance of this great case-finding survey cannot be made before five or 10 years have elapsed to give time for the evaluation of the cases found and of those which have been missed.

The work of the Film Library has shown no sign of decreasing during the past three years since the survey was completed. Every day scores of telephone calls are received and scores of letters from patients, physicians and county and city officials, some of these merely as for general information about the survey or facilities for obtaining an x-ray examination or care of tuberculosis at present, but the majority request specific information as to whether individuals had participated in the survey and what the result of the examination had been. Dozens daily ask for the film itself. More than 12,000 films have been sent out to physicians or Health Departments from the Survey Library since the survey was held. About half of these are the large 14 x 17 films taken in cases where the screening film showed suspicious shadows, though many of these 14 x 17 films were themselves reported as normal. Comparison of the shadow seen on the earlier film with the one present at the time of examination enables the physician to recognize better the nature of the lesion and its activity, as well as its probable course, and so aids in treatment and the management of the case. From the beginning requests were also made

for minifilms in which no lesion had been reported, and such requests have been actually increasing, or at least show no sign of lessening as time goes on. The value to a physician of a previous film in the evaluation of newly discovered density in the lung may be immense; fear of malignancy may be allayed if the density remained unchanged over a long period of time. Inactivity in tuberculous lesions may be similarly confirmed, or the suitability for chemotherapy or surgical therapy shown by the changes between such successive films.

In addition to receiving requests and sending out the films, the librarian sends out letters and lists requesting return of films daily, and dozens of films are received daily in response to such requests. Importance of recovering films by the library is shown by the large number of requests for films which have been already sent out. Several such requests are received daily—and it is only by continuously reminding the physicians or the clinics which borrowed the films to return them that the library is able to function completely. The librarian is also continuously engaged in rechecking and correcting the filing of the various types of materials under her care, seeing that the films are returned to their proper places, that the cards are kept in correct order, and correcting errors which had unavoidably occurred in the past.

THE LOS ANGELES X-RAY SURVEY FILM AND RECORD LIBRARY
TABLE I

| | Total to October 1953 | Per Working Day Average 1953 |
|---|--------------------------|---------------------------------|
| Telephone calls | 30,000 | 24 |
| Letters in | 20,000 | 12 |
| Letters out | 1,000 | 6 |
| (Lists of films comprizing) | 12,000 | 12 |
| Films sent out | | |
| 70 mm. | 10,000 | 8 |
| 14 x 17 | 10,000 | 8 |
| Films received | | |
| 70 mm. | 10,000 | 10 |
| 14 x 17 | 10,000 | 20 |
| Duplicate reports | | 6 |
| Requests for films that are out of Library, which are located for doctors and clinics. | | 4 |

The extensive material represented by the survey of 1950 may be supplemented by the addition of similar material from smaller surveys conducted by other agencies. All of the films and records of the surveys which have been conducted in the past by the Los Angeles County Tuberculosis and Health Association for example have already been received by the Film Library, as well as the duplicate report cards on all admission

minifilms taken at the Los Angeles General Hospital during 1952, the first year of this program. Additional films, particularly the negatives from the surveys conducted by City and County Health Departments, public schools, the various hospitals and other interested agencies in this County are also being added to the archives. Comparison of the findings in cases in such surveys who were included in the County wide survey or other series would yield much further information of value both to the individual concerned and to the evaluation of the efficacy of the various case-finding programs.

SUMMARY

Tuberculosis had represented a tremendous drain on local governmental agencies, as well as upon the people who support them. The recent decline in tuberculosis morbidity and mortality rates have already greatly lightened the relative burden to the tax-payers from this disease. For some years, however, the continuance of unrecognized cases in the population constitutes a constant menace of the renewed spread of the disease. Maintenance of the X-Ray Survey Film and Record Library constitutes a substantial contribution to the maintenance of the control and the further studies which may accelerate the disappearance of tuberculosis. The utilization of the x-ray film survey in the investigation and control of cancer, heart disease and other conditions detected by chest surveys may then be contemplated.

RESUMEN

La tuberculosis ha representado un gasto tremendo en el Gobierno así como en las personas que soportan a los enfermos. La declinación reciente de la morbilidad tuberculosa así como la mortalidad, ha aligerado grandemente la carga que esta enfermedad representa sobre los contribuyentes.

Por algunos años sin embargo, la continuación de casos no reconocidos en la población constituye una amenaza de renovada diseminación de la enfermedad. Una contribución importante para el mantenimiento del dominio de la enfermedad, es la prosecución de la búsqueda por los catástrofes radiográficos y el mantenimiento de archivos de seguimiento y los estudios ulteriores pueden acelerar la desaparición de la tuberculosis. La utilización de la investigación por los rayos X en los grandes grupos, para localizar cáncer, afecciones del corazón y otras afecciones por esos métodos, puede preverse.

RESUME

La tuberculose a représenté un appel de fonds considérable sur les administrations locales aussi bien que sur le public qui l'a subi. La diminution récente de la morbidité et de la mortalité a considérablement allégé le fardeau de ceux qui contribuaient à payer les frais de cette affection. Pendant quelque temps cependant, il continuera à y avoir des cas non diagnostiqués dans la population et ainsi persistera une menace d'une extension nouvelle de la maladie. Il faut persévérer dans les examens radio-

logiques systématiques et dans la mise à jour des archives des malades, qui réalisent une importante contribution à la lutte contre la maladie, et la continuation des recherches scientifiques qui hâteront la disparition de la tuberculose. C'est alors que l'on pourra fixer son attention sur le rôle des examens systématiques dans la recherche et le traitement du cancer, des affections cardiaques et d'autres affections qui peuvent être découvertes par ce procédé.

The Ballistocardiogram in the Presence of Pulmonary Disease

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The purpose of this study was to determine the value of ballistocardiography in differentiating cardiac from pulmonary pathology in patients with pulmonary tuberculosis. Clinically, the picture is at times not well delineated. Dyspnea and pain occur in both pulmonary and cardiac disease, and the electrocardiogram in many cases of pulmonary disease presents non-specific abnormalities, mostly due to mediastinal shift and rotation.¹ Fluoroscopic or roentgenographic examination is frequently not conclusive due to the indiscernibility of the cardiac contour in the haze of pleuro-pulmonary distortion. It was, therefore, hopefully attempted to look for new avenues of approach to the problem of differential diagnosis.

Procedure

The ballistocardiograms of 100 consecutive patients were analyzed primarily as to form and amplitude of the systolic and diastolic complexes. The apparatus used was the Glennite Ballistocardiograph made by the John Peck Laboratories of New York. Some tracings were obtained under basal conditions. Most tracings, however, were secured about two or three hours after breakfast or after lunch. Only tracings of patients who appeared nonchalant and relaxed were used in this study. All patients had pulmonary tuberculosis in various stages of activity—unilateral or bilateral. Some had unilateral pneumothorax at the time the tracings were obtained. All were ambulatory and none had associated difficulties. None were tachypnoeic or dyspneic. Those who seemed not to be able to obey commands of holding breath, etc. were not included in the study. None had evidence of cardio-vascular disease. Simultaneous complete electrocardiograms were obtained in all cases. The age groups were as follows: 63 cases were between the ages of 16 and 40; 20 were in the fifth decade; 17 were 50 years old or older.

Results

In the analysis of our series a patient was considered to have a normal tracing if the normalcy appeared in any phase of respiration—and leniency was generally applied to the interpretation of the normal, based on preliminary experience and anticipation of "more than usual" respiratory variations.

Of the 68 below the age of 50 and without therapeutic pneumothorax, 29 had normal electrocardiograms and normal ballistocardiograms; 24

From the Cardiac Service of Sea-View Hospital, Staten Island, N. Y.

had normal electrocardiograms and abnormal ballistocardiograms; eight had abnormal electrocardiograms and normal ballistocardiograms. The abnormalities in the electrocardiograms were those seen in mediastinal shift and were not interpreted as indicative of myocardial damage; seven presented abnormal electrocardiograms and abnormal ballistocardiograms. *The total number of abnormal ballistocardiograms in this group was 31.*

There were 15 below the age of 50 with therapeutic pneumothorax. Of this group seven had normal electrocardiograms and normal ballistocardiograms; five had normal electrocardiograms and abnormal ballistocardiograms; one had an abnormal electrocardiogram and a normal ballistocardiogram; in three both the electrocardiogram and the ballistocardiogram were abnormal. Thus, in the combined group of 83 patients below the age of 50—39 (50 per cent) had abnormal ballistocardiograms.

In 15 of the 20 individuals in the fifth decade, the electrocardiogram was normal and the ballistocardiogram was abnormal. In two cases both the electrocardiogram and the ballistocardiogram were abnormal. In two instances the electrocardiogram and the ballistocardiogram were normal and in one case the electrocardiogram was abnormal and the ballistocardiogram was normal. Thus, in the fifth decade group of 20 patients, *only three had normal ballistocardiograms.*

Of the 17 in the older age group (50 plus) none had an abnormal electrocardiogram. Only three had a normal ballistocardiogram. Two of the abnormal tracings were considered to belong to class two (Brown et al).² The rest belonged to group three and four (Brown et al).

The heart rate in the majority of the entire group of 100 cases studied varied between 80 and 100 per minute. Twenty had a heart rate of 80 or lower. Nine of this group had abnormal tracings and 11 had normal ballistocardiograms.

The Trace

The following observations were made in the ballistocardiograms of the series studied. In the few cases with tachycardia only L and M waves could be distinguished in the diastolic phase. In many cases in the same strip marked fluctuations in the depth of the I wave and amplitude of IJ and JK were frequently encountered. I was frequently shallow in inspiration and occasionally in expiration. JK was frequently seen to be unusually small in inspiration and occasionally notched. K was seen to be frequently deep in both the inspiratory and expiratory phase. The IJ/JK ratio was frequently smaller in inspiration than in expiration. By the same token the total systolic amplitude was frequently smaller in inspiration than in expiration. The diastolic waves were marked by inconstancy in form and amplitude. H and L were frequently markedly exaggerated and variable in the same strip. H was occasionally notched in expiration or inspiration.

On a number of occasions the "resting" tracings were bizarre and assumed a normal configuration in either the inspiratory or expiratory phase.

It was occasionally observed that a tracing was good one day and not definitive the next day, for no apparent reason. Differences in amplitude

and form were obtained in tracings taken in the morning and afternoon of the same day. Some tracings were better immediately after a meal than on an empty stomach. Two tracings presented low amplitude complexes. One for no obvious clinical justification assumed a normal pattern at a later date. She was 36 years old with an abnormal electrocardiogram, interpreted as due to mediastinal displacement and rotation. The other was a 24-year-old female with a low voltage electrocardiogram in the standard leads. The ballistocardiogram in this case presented a systolic amplitude of 4 mm. in the resting and inspiration tracing. In expiration the amplitude was only 3 mm. I and K were shallow. I was particularly shallow in inspiration. In seven cases traces were obtained prior to and following establishment of pneumothorax. It appeared that in this small series the H and L which were exaggerated in the pre-pneumothorax



FIGURE 1: Normal ballistocardiogram. Abnormal electrocardiogram.

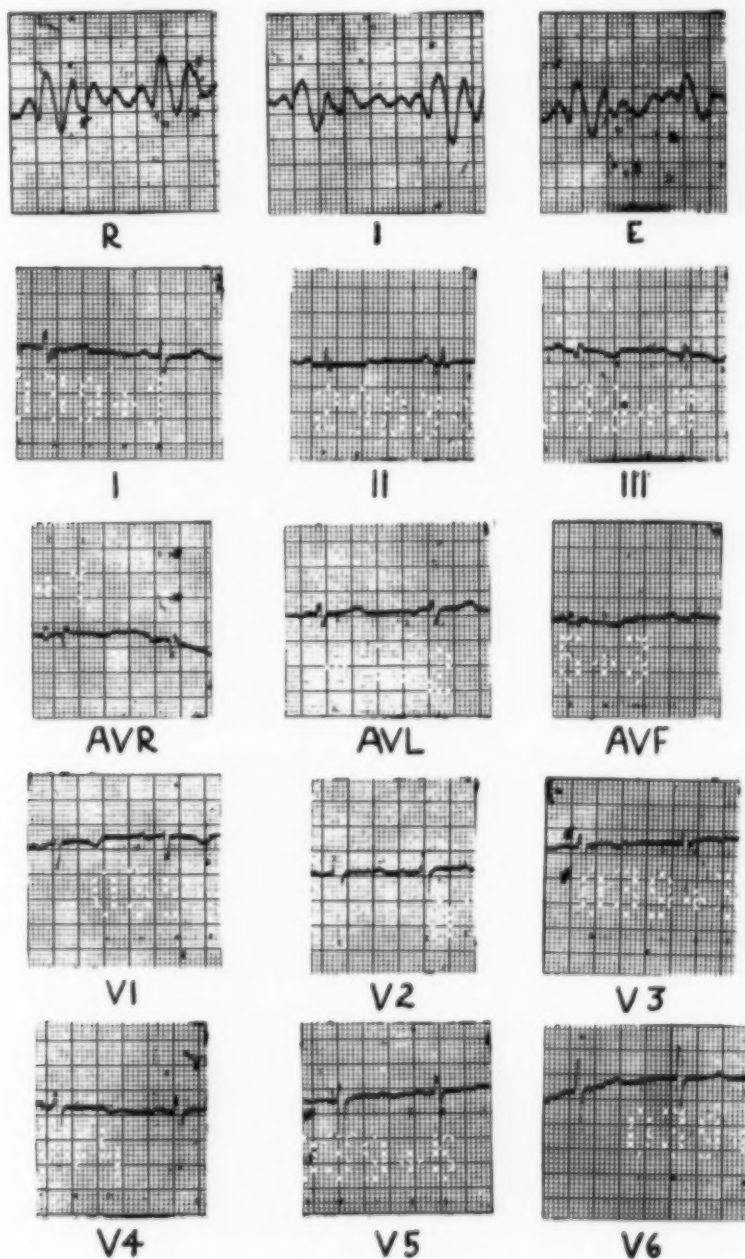


FIGURE 2: Note variations in all respiratory phases. Abnormal electrocardiogram.

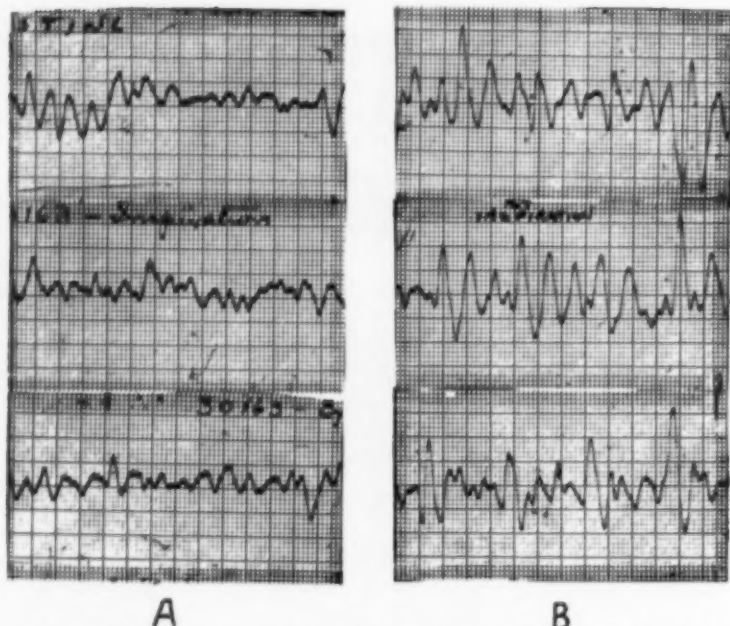


Figure 3A: Ballistocardiogram obtained before breakfast, grossly abnormal—Figure 3B: Ballistocardiogram obtained shortly after lunch. Note definitiveness in the expiration phase with changes in amplitude of the systolic complex, slurring and notching of IJ and JK.

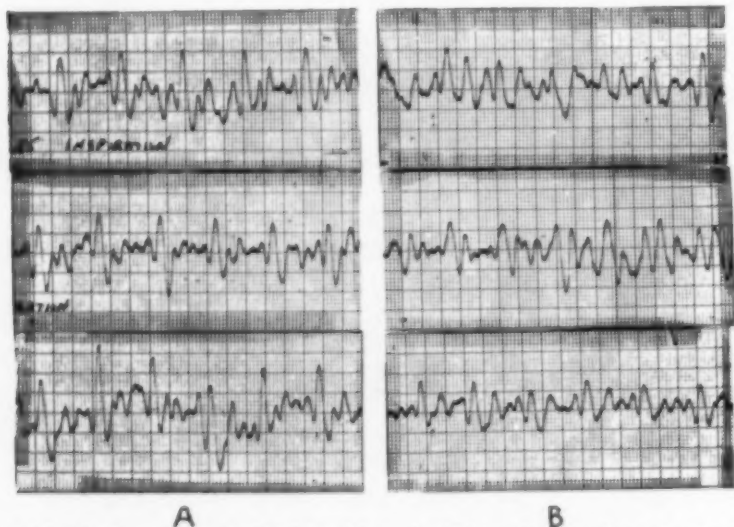


Figure 4A: Tracing obtained at 9 A.M. Normal.—Figure 4B: Tracing of same patient at 2 P.M. Note abnormalities with normal respiration (resting), shallow I in the inspiration phase and stability of pattern in the expiration phase.

tracings *diminished* in amplitude following institution of pneumothorax. In two the pre-pneumothorax tracings were classified as belonging to group two (Brown et al). Following pneumothorax the tracings were normal—both in the expiration phase only.

Positional

In 31 cases ballistocardiograms were obtained in the prone, right and left lateral positions. It was reasoned that perhaps in some positions and not in others will the respiratory rhythm be more regular and the mechanical interference with respiration will be lessened, and perhaps a change will take place in the intrathoracic dynamics and thus modify the cardiac outflow. It was realized that the lateral position introduces the factor of change in surface contacts. Care was exercised to have the patient in the best possible resting condition and the apparatus was carefully positioned so as to avoid technical errors. Since most of the patients had bilateral pulmonary disease of varying degree, no position could be assumed to be the optimum position. Further studies are now being con-

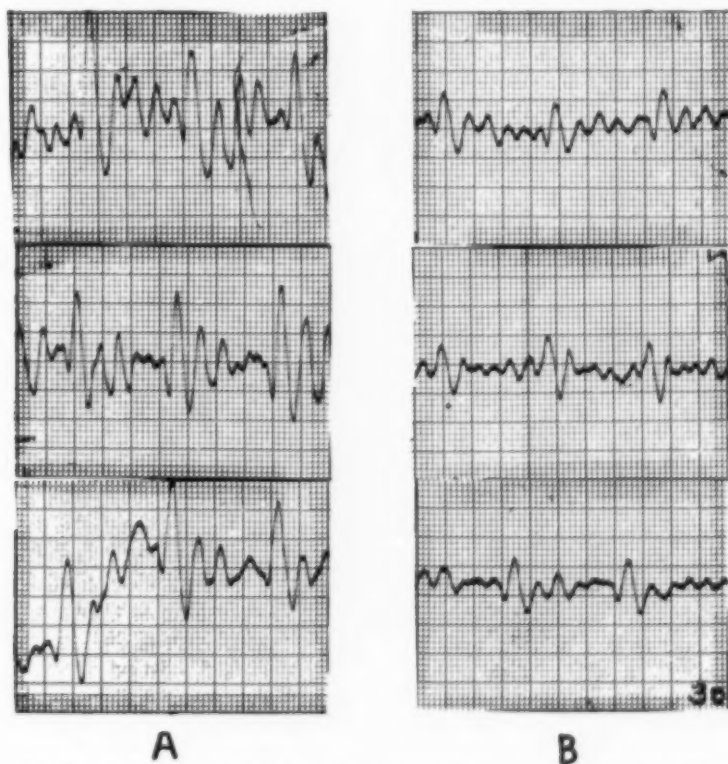


Figure 5A: Tracing obtained at 9 A.M., after breakfast.—Figure 5B: Tracing of same patient obtained at 2 P.M., about 2 hours after lunch. Note change in amplitude. Note shallow I and deep K in the inspiration phase. (Middle tracing).

ducted with a more select group of patients in order, perhaps, to gain a more correct impression of the influence of pulmonary function on the ballistocardiogram.

The following observations on the effect of position on the ballistocardiogram were made in the 31 cases studied.

The amplitude of the systolic complex was diminished in the lateral positions, at times markedly so, with an occasional exception when the amplitude was of the same magnitude or better. J frequently became smaller in the lateral positions, and occasionally notched. H frequently became larger, L frequently became larger and occasionally notched. IJ was frequently shorter and variable in the lateral positions. K became deeper.

Occasionally an abnormal tracing appeared approaching normal when the patient was lying on the side of more extensive pulmonary involvement. But generally, when a tracing was abnormal in the prone position, it was also abnormal in the right and left lateral positions.

One abnormal tracing (class 3, Brown et al) in the prone position became normal in the right lateral position in the inspiratory and expiratory phases, but not in the resting phase. In one abnormal ballistocardiogram the right lateral resting tracing was normal, in another one it became normal in the right lateral position on inspiration only.

Of the 17 normal tracings in the prone position (in this group of 31

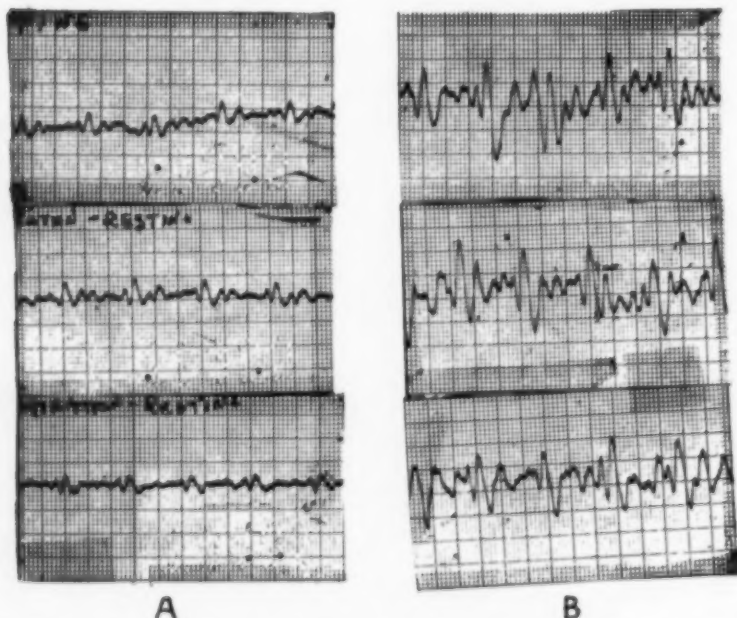


Figure 6A: Tracing of a patient secured on June 2, 1953.—Figure 6B: Tracing of same patient on June 17, 1953. Note difference in amplitude. No demonstrable clinical or technical justification.

cases) only three tracings were normal in the lateral position—with variations, however, in the amplitude of the various systolic and diastolic components. Fourteen had abnormal ballistocardiograms (Brown—2 and 3) in the lateral positions. Since the abnormalities noted in this group were not only of amplitude but also of form and component relationship, the technical arrangement of the generating components cannot be held accountable. The fault must lie in the circulatory forces and their vectorial arrangement (Figs. 10 and 11).

Discussion

The statistical part of this report, is probably not of much significance. The figures would likely differ considerably in the next consecutive 100 cases. Only considerations of a general nature are permissible. In our earliest experience with the ballistocardiogram at Sea-View Hospital it became rather obvious that the graph is not a diagnostic expression of circulatory disease proper. On the contrary we were tempted to assume that the ballistocardiogram is more a reflection of "pulmonary physiologic

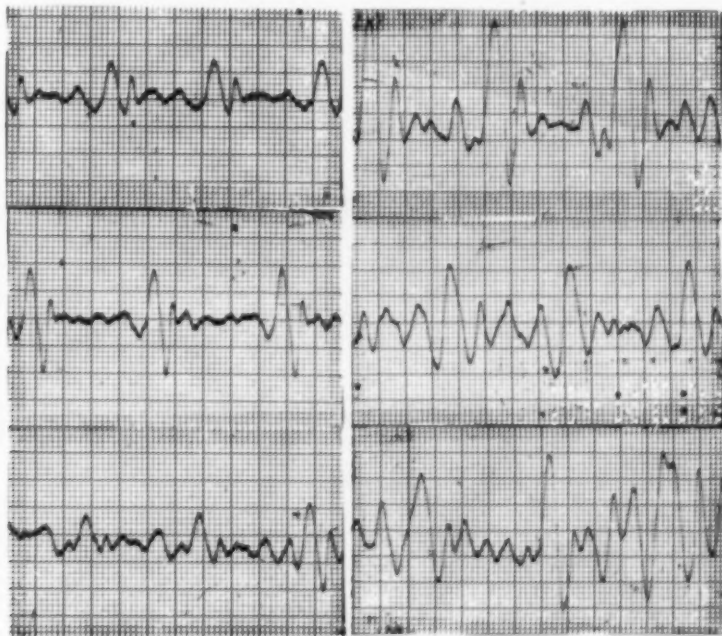


FIGURE 7

FIGURE 8

Figure 7: Upper tracing—normal respiration. Middle tracing—inspiration phase. Note deep K (paradoxic). Lower tracing—expiration phase. Most definite and stable. Deep I (paradoxic).

Figure 8: Upper tracing—normal respiration. Middle tracing—inspiration phase. Lower tracing—expiration phase. Compare I in inspiration and expiration. Note notching of H (?) in inspiration and L (?) in expiration.

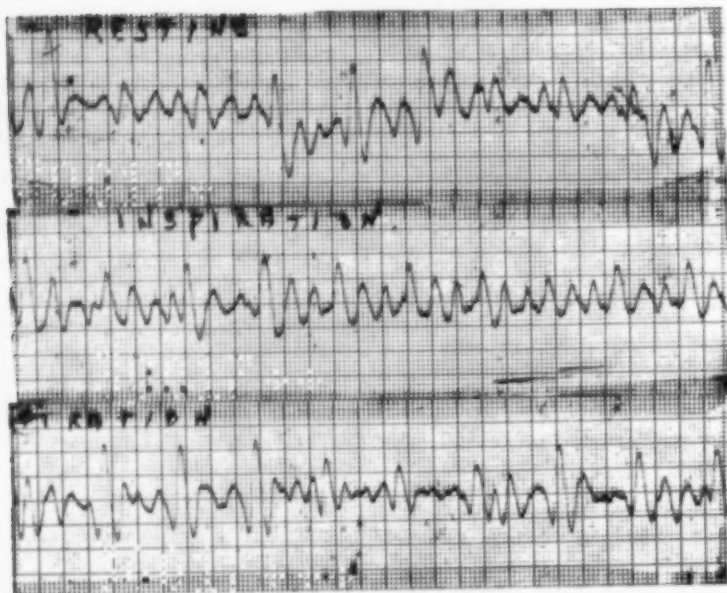


FIGURE 9: Case of herniation of right lung into left. Expiration tracing most definite and stable. I deeper than in the inspiration phase.

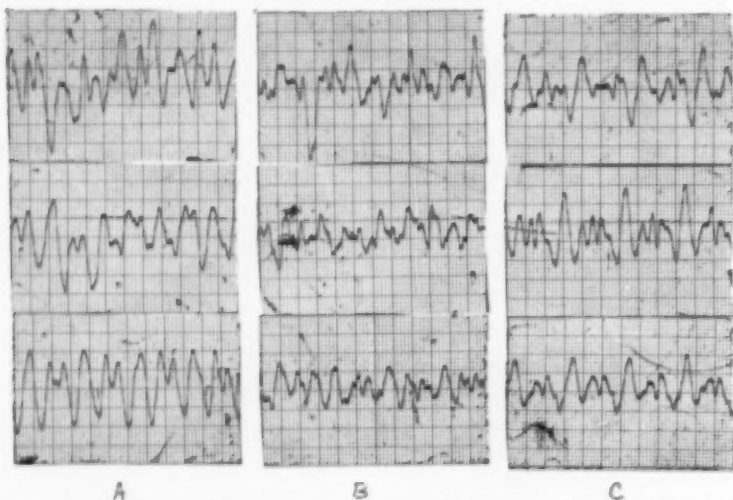


FIGURE 10: Case one of left pneumothorax. *Figure 10A*: Prone position.—*Figure 10B*: Left lateral position.—*Figure 10C*: Right lateral position. Upper tracing—normal respiration. Middle tracing—inspiration phase. Lower tracing—expiration. Best tracing obtained in the right lateral position. The inspiration tracing is the most definable and normal.

state" rather than of cardiac or vascular abnormality. That the ballistocardiogram is dependent on respiratory function is a known fact.³ It appears, however, that in the presence of pulmonary disease, this respiratory component is of major importance.

Is it because of the distorted pulmono-vascular anatomy or changes in the intrathoracic pressure due to respiratory arrhythmia that the auricular filling and the ventricular ejection become so chaotic so as to cause the marked structural changes in the tracing? Or are there other factors not readily explainable? Does the labile ballistocardiogram indicate an ever changing systemic circulatory state when pulmonary disease is present? Or does it represent variations in direction, quantity and force of the pulmonary circulation? To be more specific, is the short HI segment frequently observed in the inspiration tracing of our series due to para-

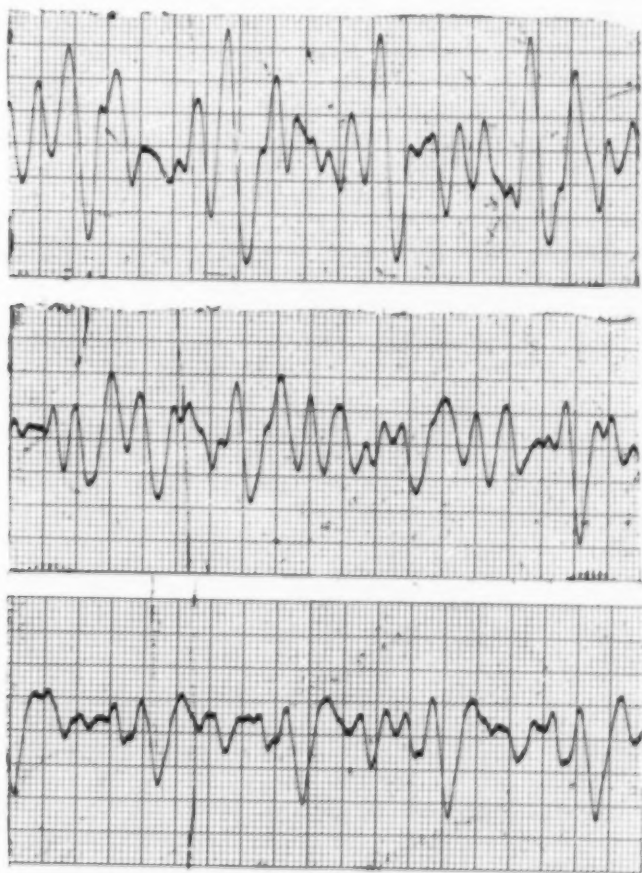


FIGURE 11: Upper tracing—inspiration phase in the prone position. Middle tracing—inspiration phase in the left lateral position. Lower tracing—inspiration phase in the right lateral position. Note IJ and JK relationship in the various positions as well as the variations in the form and amplitude of the diastolic waves.

doxical changes in the intrathoracic pressure—because of pleuro-pulmonary or pleuro-diaphragmatic adhesions? Or are there other factors not quite discernible at present to explain this phenomenon or the deep K when not expected or the exaggerated diastolic complexes? We have not observed in this analysis any constancy of sufficient degree in any of the components of the ballistocardiogram to permit cause and effect speculations. Only a few facts stand out prominently. Abnormal ballistocardiograms occur in patients with pulmonary disease in the absence of heart disease in all age groups. Age, however, seems to be a factor, in that the frequency of abnormalities increases with years. While in the general literature on the subject, one speaks of a ballistocardiogram below the age of 50 and above the age of 50, in patients with pulmonary disease the age of 40 seems to be a more distinct dividing line. Another observation of significance seems to be the fact that a single tracing obtained in the "usual" prone position may *perhaps* be sufficient in the patient without pulmonary disease; in the presence of pulmonary disease a tracing should not be considered abnormal unless obtained in various positions and various phases of respiration, and repeated in the same manner on the same or following day. Because of the extreme lability of the structure of the complexes in the presence of pulmonary disease a more liberal approach to the interpretation of the amplitude and form of the individual complexes is essential.

In a general way the following remarks are perhaps justified: Abnormalities observed under certain circumstances of stress are not dissimilar to the ones we observed in our series.⁴ This suggests the possibility that changes induced by stress are at least in some measure dependent on the integrity of the respiratory mechanism. As an alternative, one would have to suspect that many changes in the ballistocardiogram are non-predictable, non-specific and not diagnostic of distinct cardiac or vascular entities and do not reflect in *all instances* the force of ventricular ejection. "The varying amplitudes of deflections obtained with repetitive recordings at the same amplification sensitivity also indicate that"—with the device employed in our study, the tracing cannot . . . "be used to quantitate initial cardiac force in a manner similar to the method used with a ballistocardiographic table."⁵ We have not observed any of the components of the ballistocardiogram to be the least variable and therefore more or less dependable for calculation purposes.

The role of extracardiac factors in producing ballistocardiographic abnormalities and particularly the role the pulmonary mechanism plays in altering some of the components of the ballistocardiographic tracing has been emphasized by other observers.^{6, 7, 8, 9, 10, 11, 12} Thus, even in the presence of heart disease the H and L waves in the ballistocardiogram of mitral stenosis are stated to be due to changes in the pulmonary circulation. Our report further stresses the fact that abnormalities in the I wave, shortening of I-J stroke with increase in the prominence of the K wave, low amplitude and even generally indefinable patterns can occur in the absence of heart disease.

The importance of the pulmonary functional integrity in the structure of the ballistocardiogram is further attested by the fact that in certain cases the application of an abdominal binder may improve the appearance of the tracing.¹³ Such improvement in the ballistocardiographic picture is surely due to the improvement of the respiratory function by the elevated diaphragm as observed clinically by the application of an abdominal binder or the institution of pneumoperitoneum.

Our study permits no speculation on the subject of genesis of the individual waves in the ballistocardiogram. There is perhaps an indication, however, that both the H and L waves are related to the pulmonary status of the patient. Following pneumothorax the amplitude of the H and L waves were diminished. It would seem that the patho-physiologic state present in the diseased lung or in cases of pulmonary hypertension or in cases of cardiac failure is in some manner responsible for the increased amplitude of the H and L waves in certain cases.

SUMMARY AND CONCLUSION

The ballistocardiograms of 100 consecutive cases of pulmonary tuberculosis in the absence of heart disease, were analyzed as to form and amplitude. The number of abnormal tracings in all age groups was higher than that observed in the general population. The abnormalities observed occurred in both the systolic and diastolic complexes of the tracing. Some of the abnormalities were paradoxical, simulating reflection of circulatory stress rather than expressing respiratory dependence.

It is suggested that in the presence of pulmonary disease, ballistocardiographic tracings should be secured in various positions and various respiratory phases, and that generally the interpretation of ballistocardiogram be more cautious and lenient.

Grateful acknowledgement is made to Miss Katherine Moore and Miss Leonora Fox for rendering technical assistance in the preparation of this paper.

RESUMEN

El balistocardiograma en 100 casos consecutivos de tuberculosis pulmonar en ausencia de afección cardíaca, se analizó en su forma y amplitud. El número de trazos anormales en todas las edades fué más alto que el observado en la población general.

Las anomalías observadas ocurrieron tanto en el complejo sistólico como en el diastólico de 1 trazo. Algunas de las anomalías fueron paradójicas, simulando reflexión del esfuerzo circulatorio más bien que dependencia respiratoria.

Se sugiere que en presencia de tuberculosis pulmonar, deben obtenerse trazos balistocardiográficos en varias posiciones y en diversas fases respiratorias y que generalmente la interpretación de los balistocardiogramas ha de ser cauta y no severa.

RESUME

Les auteurs ont analysé dans leur forme et dans leur amplitude les balistocardiogrammes de cent cas de tuberculose pulmonaire chez lesquels

il n'y avait pas d'affection cardiaque associée. Le nombre des tracés normaux dans les groupes de tous âges fut plus élevé que celui qu'on observe généralement dans l'ensemble des individus non tuberculeux. Les anomalies qui furent notées atteignaient à la fois les complexes systoliques et diastoliques. Certaines d'entre elles donnaient paradoxalement l'impression d'une atteinte circulatoire beaucoup plus qu'une altération secondaire à une atteinte des voies respiratoires.

Les auteurs sont d'avis qu'au cours d'une affection pulmonaire, les tracés ballistocardiographiques doivent être pris en diverses positions et au cours de différentes phases respiratoires. Ils admettent que d'une façon générale, l'interprétation d'un ballistocardiogramme doit être prudente et réservée.

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Surgical Trends in Pulmonary Tuberculosis*

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There has been a tremendous change, during the past few years, in the manner in which we treat patients with pulmonary tuberculosis. If my former chief, Dr. Ralph C. Matson, were to attend one of our staff conferences at the University of Oregon State Tuberculosis Hospital today, I am sure that he would be greatly shocked to hear the recommendations that were being made. I, too, am sometimes disconcerted when I realize that for the vast majority of cases, presented at our conferences, we are ultimately recommending pulmonary resections. Those of us who had sanatorium experience in the 30's, or earlier, must be particularly aware that many of the patients whom we now subject to excisional therapy would have been considered then to have a good prognosis with nothing more than a prolonged period of bed rest. Furthermore, it is difficult to forget the trials experienced during the years when we were first exploring the values of pulmonary resection in the treatment of pulmonary tuberculosis.

The changes that have occurred in the surgical treatment of pulmonary tuberculosis, as they have evolved with us at the University Hospital, are evidenced by Table I which shows the numbers of certain operations that we have performed at four-year intervals since the hospital was opened late in 1939.

The thoracoplasty figures do not include "tailoring" thoracoplasties performed at the time of resections or decortications. They do include stages that were performed as separate operations before or after resections. The figure for the number of patients operated on is really that for the number of lungs subjected to major surgery. During the last two years an increasing number of patients have had bilateral surgery.¹ Figures for decortication or decortication with thoracoplasty are not included except in the totals.

TABLE I
OPERATIONS PERFORMED AT THE UNIVERSITY STATE
TUBERCULOSIS HOSPITAL
Portland, Oregon

| | 1940 | 1944 | 1948 | 1952 |
|---|------|------|------|------|
| Pulmonary resections | 0 | 16 | 19 | 85 |
| Thoracoplasties (all stages) | 20 | 57 | 106 | 13 |
| Extrapleurals | 29 | 1 | 1 | 3 |
| Other major operations | 0 | 0 | 6 | 2 |
| Total Major Operations | 49 | 74 | 132 | 113 |
| Total Minor Operations | 87 | 48 | 45 | 7 |
| First-stage thoracoplasties | 11 | 20 | 41 | 8 |
| Number patients having major operations | 40 | 37 | 67 | 100 |

*Presented at the First Annual Session of the Western Tuberculosis Conference, Salt Lake City, Utah, Sept. 18, 1953.

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Figure 1 illustrates graphically how our use of various operative procedures has changed each year since 1940 at the University Hospital. It should be noted that the surgical program in this hospital, which has only 80 beds, has always been active. The hospital admissions are generally selected from patients who are likely to be candidates for surgery and patients who, because of complications, may require the special facilities provided by the medical school. In 1940, when most of our patients received artificial pneumothorax therapy, most of the operative procedures were classified as minor and included primarily closed intrapleural pneumonolyses and phrenic nerve interruptions. Of the major operations performed in 1940, extrapleural collapse procedures predominated. Dr. Matson's extrapleural pack (gauze packing, sometimes impregnated with oil of gomenol or iodoform, encased in a sheet of plastic flexi-tissue) was giving most encouraging early results. Late complications in patients so treated—infections and fistulae—caused us to return to thoracoplasty for more and more of the patients in whom surgical collapse seemed indicated. The use of thoracoplasty reached its peak in 1948. The sharp increase in the number of thoracoplasties during that year reflected the shorter period of preparation for surgery required when patients were given streptomycin and the increased safety and improved results of surgery in patients so treated.

The number of first stage thoracoplasties performed each year approximates the number of patients on whom thoracoplasty was performed as a primary procedure. While during most years there was an average of almost three stages performed on patients undergoing thoracoplasty, the average has now dropped to less than two. During the last four years the number of primary thoracoplasties has dropped in inverse ratio to the increase in the number of resections performed. In fact four of the eight first stages performed during 1952 were post-resection thoraco-

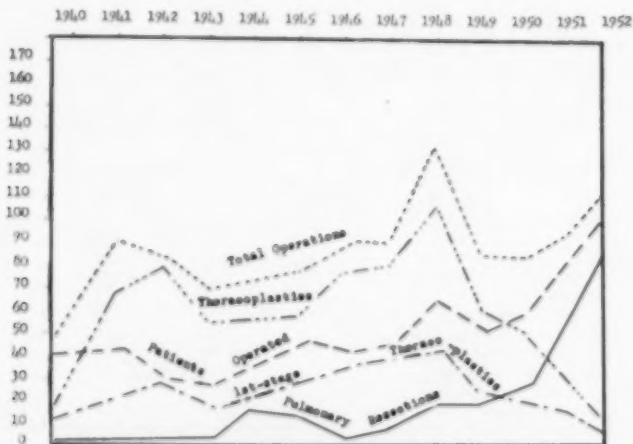


FIGURE 1: Graphic illustration of various operative procedures used at the University State Tuberculosis Hospital, by years (see text).

plasties. Of the four primary thoracoplasties, two were performed in one stage, one in two stages and one in three.

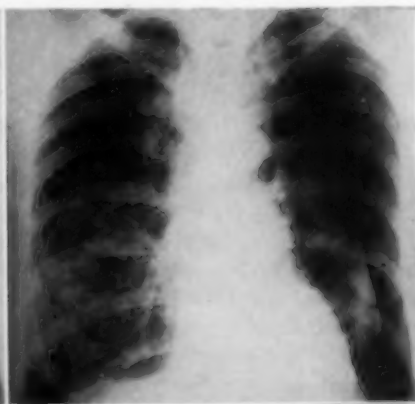
Insofar as pulmonary resections are concerned it will be noted that we did a number in 1944 and 1945. There were enough serious complications in this group of resections to cause a marked decrease in the number of resections undertaken during the next two years. Resections were again undertaken in larger numbers following the advent of streptomycin and the results have seemed so gratifying that, as the graph indicates, we are now performing them almost to the exclusion of all other types of surgery for tuberculosis. The serious complications of resection have become much less frequent and are more readily controlled since the antimicrobial drugs for tuberculosis have become available. But the mere fact that resection for pulmonary tuberculosis is safer now than formerly is not in itself a valid reason for preferring resection to collapse therapy. I propose therefore to explore the reasons for which we, and many others who treat tuberculosis, have largely abandoned the use of the older, well tried forms of collapse therapy in favor of resection therapy.

Artificial Pneumothorax and Closed Intrapleural Pneumonolysis

Ten years ago few experienced phthisiologists would have questioned the statement that artificial pneumothorax was the treatment of choice in most cases of pulmonary tuberculosis in which there were no contraindications and in which an adequate collapse could be established. In some cases it was considered the *sine qua non* for possible arrestment of the disease. At our staff conferences, in discussing the management of new admissions, first consideration was generally given to the advisability of trying artificial pneumothorax. In perhaps 80 per cent of patients an attempt to establish it was made, either as soon as preliminary studies had been completed or after a period of bed rest had shown little or no improvement. Not only could it control some far advanced lesions which tended to progress on a strict sanatorium rest regime, but there was also considerable evidence that patients with small cavities, or even those with minimal exudative disease, were less likely to manifest late reactivation if subjected to two or more years of pneumothorax collapse.

We are all aware that artificial pneumothorax, with the aid of pneumonolysis where indicated, has arrested the disease or prolonged the lives of hundreds of thousands of patients with pulmonary tuberculosis. It still can do so. It could do so better now than formerly, since antimicrobial drugs are eminently effective in overcoming most of the contraindications to and the complications of artificial pneumothorax therapy.

But it remains to be seen whether artificial pneumothorax will have any place at all in the future treatment of pulmonary tuberculosis. Because of economic considerations involved in a type of treatment which is relatively prolonged and inconvenient for the patient, because of late complications (such as tuberculous empyema, bronchopleural fistula and non-expandable lung) and because of an appreciable incidence of late reactivations occurring in patients treated thus in the past (for the most

FIG.
2AFIG.
2BFIG.
2CFIG.
2D

V. L. White male, age 42. Minimal pulmonary tuberculosis diagnosed in 1940. Sanatorium care in 1940 for three months, in 1942 for six months and in 1945 (*Figure 2A*) for 14 months. In 1945 left artificial pneumothorax was established.

First admitted to University State Tuberculosis Hospital in 1947 when right pneumothorax and pneumonolysis were performed. Readmitted to University State Tuberculosis Hospital in 1952 (*Figure 2B*) when the apical and posterior segments of the right upper lobe were resected and the remainder of the right lung was decorticated. The patient had severe essential hypertension (BP 220/140) and so right sympathectomy (T2 to L2) was performed at the same time.

During decortication the right phrenic nerve was inadvertently severed. It was resutured, however postoperative diaphragmatic paralysis was considered largely responsible for the very stormy postoperative course. The patient was unable to raise his secretions and developed atelectasis, (*Figure 2C*) despite repeated tracheobronchial aspirations. A persistent air leak required a secondary thoracotomy about two weeks later.

Because of the stormy course this patient refused the contralateral surgery which had been contemplated. He reconsidered, however, and returned a year later for decortication on the left with wedge resections of large granulomas in both the upper and the lower lobe. A left dorsal sympathectomy (T2 to L1) was performed at the same time. Convalescence from this operation was smooth (*Figure 2D*).

This patient's last positive sputum was just before his last operation in April, 1953. He was discharged from the hospital in July, 1953. In October 1953 his condition seemed excellent. He was moderately active. His blood pressure had stabilized at about 130-140/100 and his right hemidiaphragm had a normal excursion of about 4 cms. indicating phrenic nerve regeneration.

(A) Prior to establishment of left artificial pneumothorax.

(B) Prior to right decortication, resection and sympathectomy, when right phrenic nerve was inadvertently severed.

(C) Postoperative atelectasis and persistent "air leak," requiring secondary thoracotomy.

(D) Following left decortication, resection and sympathectomy.

part before the advent of streptomycin), we have practically abandoned the use of artificial pneumothorax. I suspect that Dr. Matson, and other pioneers, would be greatly disheartened by the feeling that their extensive clinical research had been cast overboard. We would wish them to know that this work has not been wasted. After all, the good it has already accomplished in the salvage of human life is of inestimable magnitude. But we further owe it to these early workers, as well as to our patients, to determine whether or not indications for artificial pneumothorax in pulmonary tuberculosis may still exist. I shall be particularly interested to know what becomes of patients who are treated with artificial pneumothorax, perhaps only for relatively short periods, in conjunction with long continued antimicrobial therapy. Undoubtedly there are investigators who will determine this. We still feel that short-term artificial pneumothorax, along with medical treatment, may have value in promoting stabilization of active disease preparatory to contemplated lung resection, even if it does not eliminate the need for such a resection.

Phrenic Nerve Interruption

While interruption of a phrenic nerve has certainly had its place in phthisiotherapy, I am convinced that it not only has been used too frequently in the past but that its indications will become increasingly restricted in the future. Never particularly dependable for the "collapse" treatment of parenchymal lesions, it has always carried with it the possibility of undesirable sequelae and complications.

Permanent paralysis of a hemidiaphragm results in rather severe permanent loss of respiratory reserve. While phrenic interruption by crushing, the only acceptable procedure today, is usually followed by regeneration and return of function, complete return of function is probably seldom achieved and permanent total loss of function occurs at times. As measures for treating pulmonary tuberculosis which involve minimal loss of respiratory reserve become more generally available, preservation of function assumes an increasingly important place in the management of this disease.

In treating pulmonary tuberculosis it is also important to keep in mind that failure to control the disease, or its later reactivation, may require the use of surgical therapy which was not at first contemplated. It is well established that patients who have a paralyzed hemidiaphragm are more difficult to manage properly and more prone to develop complications following any major surgery that may become necessary. Figure 2 (Case VI) illustrates such a case.

During the past year we have performed phrenemphraxis twice in patients who had persistent "air leaks" following pulmonary resections. In both it appears to have been helpful. We do not recognize any other indication for this procedure at present, though others still often employ it (usually combined with pneumoperitoneum) in patients who are not considered to be candidates for resection or thoracoplasty.

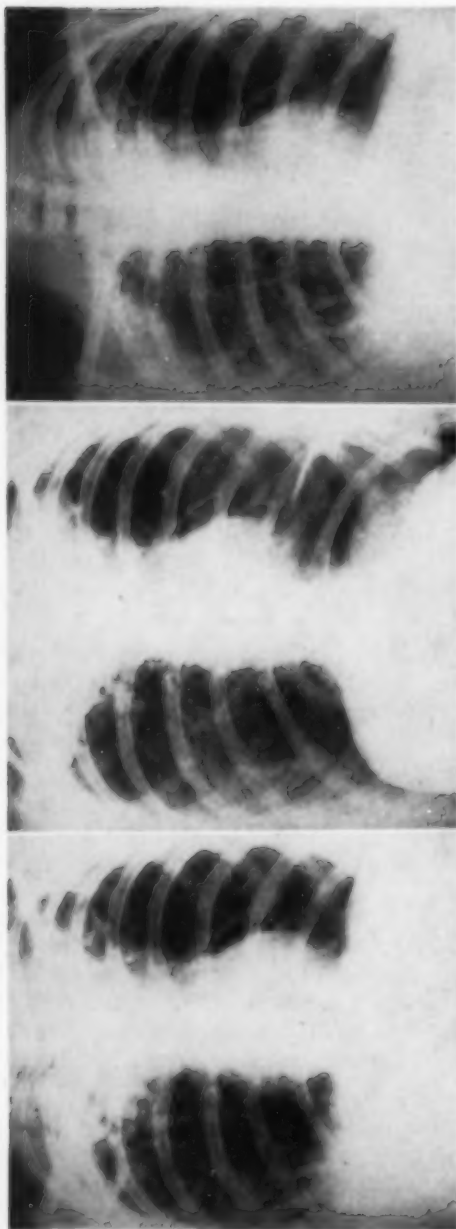


FIGURE 3A

FIGURE 3B

FIGURE 3C

M. M. a white female, age 49. Pulmonary tuberculosis first diagnosed in 1934 following pregnancy. Treated with bed rest, left pneumothorax (22 months), sandbags and gold salts. In 1936 a new lesion developed on the right side at the time of another pregnancy. Treatment included bed rest and right phrenephraxis.

Apparently well until 1951 when she was admitted, following an acute febrile illness, with far-advanced bilateral pulmonary tuberculosis. (Figure 3A) Gratifying response to antimicrobial drugs and pneumoperitoneum. (Figure 3B) Thoracoplasty performed preliminary to contemplated resection. Resection later considered unnecessary. (Figure 3C) Has been home and fairly active since September, 1952. Last positive sputum was in October, 1951.*

*A small cavity has recently opened beneath this thoracoplasty. Pulmonary resection may still become necessary.

Pneumoperitoneum

We find that our use of artificial pneumoperitoneum has increased as our use of artificial pneumothorax has fallen off. Particularly in conjunction with antimicrobial therapy and bed rest, pneumoperitoneum apparently tends to promote healing of tuberculous disease; but its use in a large proportion of sanatorium patients, as recommended by some, still is controversial. Usually we do not consider that this combination effects sufficient resolution to obviate the need for more definitive surgery. It is a combination that has seemed useful in patients whose disease is of such a nature or extent that other types of active therapy are too hazardous, or otherwise contraindicated. More often it is a therapeutic regime which we may use for several months to prepare patients for unilateral or bilateral resections. Despite hopes to the contrary, the resections have eventually almost always seemed necessary.

A house doctor on our service once had the grave misfortune of producing fatal air embolization while giving a pneumoperitoneum refill. Such a disaster, rare though it be, emphasizes the fact that what seems an innocuous procedure is not without some danger and that there should be ample justification before it is used.

Thoracoplasty

There was a time when we would recommend thoracoplasty for practically all cases of cavitary disease, particularly unilateral, in which adequate artificial pneumothorax could not be established. We perform few primary thoracoplasties today. They are done occasionally for cavitary disease which is predominantly in the upper lung field, when there is such extensive scattered involvement in the remainder of the lung that subtotal lung resection appears to be out of the question. Very sick patients for whom resection appears necessary can often be improved by thoracoplasty, along with antimicrobial therapy, to the point where lung resection can be performed with much greater safety. In a couple of cases, treated in this way, the contemplated resection was later considered unnecessary (Fig. 3). More often, however, primary thoracoplasties which were expected to control the disease have failed to do so and lung resection has eventually had to be performed.

At present we seldom perform thoracoplasty except as an adjunct to resection. We feel that the standard thoracoplasty, devised by Alexander for adequate collapse of upper lung disease, involves excessive loss of function due to the necessity of collapsing good as well as diseased lung, due to the scoliosis which is frequently unavoidable, and due to considerable trauma to the muscles and nerves of the chest wall and shoulder girdle. If all the significant disease can be resected without performing thoracoplasty, or with only a concomitant "tailoring" thoracoplasty such as we have described in a previous publication,² there is good evidence, both subjective and objective,³ that much more respiratory function can be preserved.

While evidence appears to be accumulating to discount the wide-spread belief that over-distention of remaining lung tissue, following pulmonary resection, contributes significantly to loss of pulmonary function or promotes exacerbation of non-resected tuberculous lesions^{3, 4} we still consider it advisable to obliterate, at least partially, any large dead space remaining following resection. A "tailoring" thoracoplasty involves practically no deformity and, properly performed, it doesn't collapse non-involved lung tissue. It prevents excessive distortion of trachea, bronchi and pulmonary vessels and aids in the prevention or control of the complications which sometimes occur following resection. We have been performing thoracoplasties at the time of resection in about 25 per cent of those resected. When thoracoplasty is performed in advance of resection the same type of thoracoplasty should be performed—i. e., anterior segments of ribs below the first should be preserved, as should the transverse processes. However, we recommend that posterior rib stumps not be left as long as may be feasible in a concomitant "tailoring" thoracoplasty, so as to increase the possibility that later resection may be avoided. Occasionally thoracoplasty is performed two or three weeks following resection as when the remainder of the lung fails to fill the space as anticipated, when there is persistent air leak from the raw surface of the partially resected lung, or rarely, when the additional surgery is considered inadvisable at the time of resection. When thoracoplasty is delayed, proper "tailoring" cannot be effected as well. We therefore prefer the concomitant or preliminary thoracoplasty, though others do thoracoplasty subsequent to an upper lung resection or pneumonectomy almost routinely.

Other Surgical Collapse Procedures

It is possible that modifications of the standard thoracoplasty, including Overholt's costo-inversion thoracoplasty and extraperiosteal plombage followed by thoracoplasty, and the various types of extrapleural pneumothorax and plombage may continue to have a place in phthisiotherapy. These procedures deserve special consideration for patients with wide-spread bilateral disease when respiratory reserve is at a critical level, and particularly when there is considerable question as to a patient's ability to tolerate the thoracotomy necessary for a possible resection—e.g., following contralateral pneumonectomy. We feel that extrapleural pneumothorax and plombage can be performed with much greater safety now than before antimicrobial drugs were available, and yet, when such procedures are considered, we generally decide that resection is just as safe and offers a much more definitive approach and a much better long-term prognosis.

Decortication

In patients who have had pulmonary tuberculosis, decortication is generally performed to achieve re-expansion of a lung which is non-expandable as a result of prolonged artificial pneumothorax. Presumably decortication will be required less often in the future as the use of artificial

pneumothorax becomes less prevalent and particularly as antimicrobial drugs reduce the incidence of pleural complications, with or without pneumothorax being present. In about 50 per cent of patients on whom we have performed decortications following prolonged pneumothorax therapy, which presumably has arrested the disease, we have found and removed caseous foci in the underlying lung. Such foci are considered a potential source of late exacerbations and probably account for late development of contralateral spreads, such as are seen all too frequently in patients who are receiving, or have received, pneumothorax therapy. Significant parenchymal lesions found at the time of decortication should be removed, often by wedge or segmental resection (Fig. 2). Whether or not resection has been performed, the long collapsed lung sometimes will not expand adequately to fill the hemithorax following decortication. Under such circumstances we usually perform concomitant thoracoplasty for the same reasons that we do so with resections.

Decortication of non-expandable lungs, often combined with partial resection, should help to prevent late complications, such as empyema, fistulae, exacerbations and spreads. It is now recommended at an earlier time after the appearance of a thick "peel" than has generally been accepted in the past. While it is frequently amazing how much volume and function can be recovered in a lung that has been collapsed for many years, it is undoubtedly true that the longer the collapse has existed the less recovery can be anticipated.

In tuberculous and mixed infection empyema, with or without bronchopleural fistula, decortication will probably always find its indications. In many cases enzymatic debridement and antimicrobial therapy should first be given adequate trial. Enzymes must be used with caution, however, if at all, in the presence of a bronchopleural fistula. Jones et al.⁵ reported acute disseminated tuberculosis developing in three out of eight cases treated with enzymes, presumably because the thinned infected fluid was more readily aspirated through fistulae. Having had one such experience, we have avoided risking repetition.

An application of decortication which I have not seen mentioned in the literature is that for patients with organized pleural exudate where the diagnosis has not been established by the usual laboratory means. In one such patient the clinical picture strongly suggested malignancy with pleural invasion, and in another the referring doctor's diagnosis was Friedlander's empyema. Both were found to have tuberculous empyema at the time of decortication, and both were much improved by surgery. Decortication may well be recommended for diagnosis as well as treatment when the cause of persistent pleural exudate remains obscure.

Cavity Drainage

It is a long time since we have encountered a case in which Monaldi cavity suction drainage or cavernostomy seemed indicated. The mechanisms which produce "tension" cavities are generally eliminated by antimicrobial therapy. Even if they are not, resection again appears to be

the more definitive approach and is better performed before one has established an infected fistulous tract through the chest wall. Under unusual circumstances, however, the indications for such procedures may occasionally be encountered, particularly in far-advanced cases for whom resection seems too hazardous, or in order better to prepare a sick patient for a contemplated resection. The potential value of such procedures should therefore be kept in mind.

Pulmonary Resection

As is evident from what has been said above, pulmonary resection has appeared to be indicated in an increasingly large percentage of the patients under our care. Discussions at our conferences now seem most frequently to be concerned with the possible need for pulmonary resection, and the most opportune time for its performance when it appears indicated.

Today, as formerly, we consider that there are certain obligatory indications for resection. The presence of large "solid" lesions ("tuberculomas"), suspected neoplasm, destroyed lobes and lungs, cicatricial bronchial stenosis with significant bronchopulmonary disease distal to the stenosis, significant tuberculous bronchiectasis demonstrated by bronchography or tomography, and lesions which continue to be the source of positive sputum despite collapse and antimicrobial therapy are among the indications which we still consider incontrovertible. In most of the patients with such indications, we feel that resection should not be too long delayed. If there are acute exudative lesions present, we attempt to achieve maximum resolution and stabilization of such lesions by medical therapy, often with the aid of pneumoperitoneum, before resection is



FIGURE 4A

FIGURE 4B

H. T. Chinese male, age 23. Pulmonary tuberculosis diagnosed March, 1952. Admitted July 16, 1952 with rapidly progressive disease. (Figure 4A) Excellent response to antimicrobial drugs with bed rest and pneumoperitoneum. (Figure 4B) Repeated body section radiograms failed to reveal any residual evidence of cavitation or of granulomatous lesions. Sputum has been continuously negative since February, 1953. On admission this patient was considered a possible candidate for bilateral resection.

undertaken. This may require six months or more. Otherwise, resection is sometimes performed after only six weeks or less of preliminary study and antimicrobial therapy. Prompt resection of a solitary lesion is mandatory if one suspects that it may prove to be a malignant neoplasm.

"Tension" cavities no longer constitute an indication for early resection, in our opinion. Remarkable results are sometimes seen following prolonged medical therapy (Fig. 4); but most patients who have had a "tension" cavity do come to resection. When continuing improvement is no longer demonstrable roentgenographically, we feel that these patients should be thoroughly studied, particularly with body section radiograms, with bronchoscopy and sometimes with bronchography, in order to determine whether there are residual lesions for which resection may be advisable.

The great increase in the number of resections which we perform has resulted largely from acceptance of the concept of Medlar et al.^{6, 7, 8} that certain tuberculous lesions, often quite small, may persist as necrotic foci containing viable tubercle bacilli though treated adequately by past standards, and that these foci present a considerable hazard as a potential source of later spread or exacerbation. When well-defined tuberculous nodules, which are not calcified, are demonstrated by body section radiography and when they persist following prolonged medical therapy, we seriously consider the advisability of resection, especially if one or more of these exceeds 1 cm. in diameter and particularly if sputum cultures have been positive. Fibrotic contracted segments or lobes are also considered indications for resection. We are no longer satisfied with converting the sputum to negative in many of these cases. We are inclined, rather, to resect lesions which may persist as potential sources of new disease.

We are aware that many of the lesions which we have resected might have healed, and never reactivated, had the patients been subjected to prolonged medical management and appropriate precautions following discharge from a sanatorium. Mitchell, however, has reported at least one known progression of the disease in 35.8 per cent of 589 patients with minimal pulmonary tuberculosis who were treated with modified bed rest at Trudeau Sanatorium.⁹ Admittedly we are sometimes influenced in our recommendations by the shortage of sanatorium beds in our area and by the resultant need to maintain a relatively rapid turnover in the patients who are institutionalized. We are aware, too, that many patients with lesions such as we now resect have in the past had their tuberculous disease satisfactorily controlled by collapse therapy, carried out for long periods or for the remainder of their lives. But we know that, in the past, a significant percentage of patients treated by such methods have had to be readmitted because of reactivation of their disease and we believe that, with resection, this percentage can be materially reduced or practically eliminated. We do not yet know, unfortunately, whether the percentage can be reduced to a comparable degree as a result of adding antimicrobial therapy, without resection, to other types of

treatment in such cases. Evidence may accumulate within the next few years which will support those who feel that the pendulum has already swung too far toward a radically high proportion of resections in tuberculosis. Discovery of new and more efficient antimicrobial drugs and combinations of drugs may also alter the indications for resection. On the other hand, emergence and persistence of drug-resistant strains of tubercle bacilli in some of these patients may assume a role of increasing importance in the future and make it the more imperative to resect lesions while a patient's organisms are still sensitive to antimicrobial medications.

Pulmonary resection has become increasingly important in the management of cases of far-advanced bilateral pulmonary tuberculosis. As Woodruff has shown,³ resection causes less physiologic alteration than thoracoplasty. When conservation of function reaches a critical level, because of the extent of the pathology, it is often possible to control the disease by multiple bilateral segmental and local excisions¹ when thoracoplasties or other types of collapse therapy would excessively reduce respiratory reserve because of the inevitable simultaneous collapse of healthy lung tissue.

The techniques of resection have become well enough standardized so that they do not require detailed discussion here. We still prefer to perform a "tailoring" thoracoplasty at the time of upper lung resections if there has been so much reduction in lung volume that a large dead space is left. While there is evidence that "over-distention" of the remaining portion of the lungs may be of little or no significance from the standpoints of function and reactivation,^{3, 4} tracheobronchial distortion can produce annoying symptoms and even a small concomitant thoracoplasty appears to have definite value in the prevention of this and in the prevention and control of empyema and bronchopleural fistula. It also may have value in preventing the cardiocirculatory embarrassment which can result from excessive mediastinal displacement.

When bilateral resections are contemplated the more involved side is generally operated on first. We feel that simultaneous bilateral resections, such as have been performed by Overholt, and perhaps others, probably introduce additional unnecessary hazard in most instances. Furthermore, if the worse side is subjected to resection first, it is possible that, in some instances, the contemplated contralateral resection might later prove to be unnecessary. When decortication, with or without resection, seems indicated on one side we may prefer to perform this before resecting the more serious disease in the contralateral.¹ We feel that we may thus be able to improve respiratory function sufficiently to make the contralateral resection less hazardous. When both sides are to be operated on we generally allow a period of three or more months of convalescence between the two operations.

Widely distributed major tuberculous lesions in one or both lungs can sometimes be resected by enucleations, wedge and segmental resections, with maximum conservation of function. The good results which we have

had with bilateral as well as unilateral resections for tuberculosis, the decreased number of procedures involved as compared with thoracoplasty and extrapleural collapse, the decreased length of hospitalization and decreased morbidity, all incline us towards resection rather than collapse surgery whenever it seems likely that all major tuberculous foci can be eradicated. We have never performed resection following a contralateral pneumonectomy but believe that situations are encountered where such should be considered (Fig. 5).

Tracheobronchoplasty

In discussing the surgery for pulmonary tuberculosis some mention should be made of the brilliant work of Gebauer^{10, 11} and others who have performed plastic repairs of damaged and stenotic portions of the tracheobronchial tree. When we encounter bronchial stenosis, which seems to be

FIGURE
5A



FIGURE
5B



FIGURE
5C



FIGURE
5D



F.S., w, f, age 34. Pulmonary tuberculosis diagnosed 1942 following pregnancy (Figure 5A). Left pneumothorax initiated with conversion of sputum in three months (Figure 5B). Sputum positive in 1943 and active tuberculous bronchitis diagnosed. Treated with topical silver nitrate and pneumothorax converted to oleothorax (Figure 5C). Sputum negative. Five-rib thoracoplasty in February, 1953, oil being aspirated. Pleuropneumonectomy with resection of three more ribs on March 17, 1953 (Figure 5D). Sputum has been negative since January, 1952.

The film of October 8, 1952 (C) shows a round lesion at the right base. We considered the possibility that this might be neoplastic, but it gradually diminished in size (D). Had it not decreased in size or had it become larger, this lesion would have been resected despite the contralateral pneumonectomy.

far more rare in our area than it used to be, we generally find extensive bronchopulmonary disease distal to the stenosis, making resection obligatory. We have, however, found bronchoplasty a valuable aid to conservation of healthy lung tissue in a few instances and its potentialities should not be neglected.

Postoperative Care

It is proper, no doubt, to add here a few words regarding certain changes which have been evolving in our postoperative care of patients with pulmonary tuberculosis. Except in acutely ill toxic patients we no longer adhere to the very strict rest regimes which formerly were the rule. Following surgery we subscribe to a program of early ambulation, such as is now used in the postoperative care of most surgical patients, except that in the tuberculous patients it is instituted more gradually and over a considerably longer period of time. The average patient who has had resection is required to "dangle" and is permitted use of the bedside commode by the first or second postoperative day. He is allowed to go to the bathroom twice a day as soon as his strength permits. Barring complications or evidence of residual active disease, a graduated schedule of "up time" and walking exercise is begun approximately six weeks following surgery. Activities are gradually increased until, by the end of the third or fourth month, the patient is generally discharged from the hospital on a schedule which permits four hours sitting up in a chair and one hour of walking exercise. Many patients are permitted full activity, and even return to work, within six months following surgery, as long as there is no roentgenographic evidence of residual or new lesions for which a continued rest regime is considered mandatory.

The presence or absence of such lesions also determines the length of time that antimicrobial medications are prescribed. During the two-week period immediately following major surgery the dosage of streptomycin or dihydrostreptomycin, or combination of the two, is generally increased to 1.0 gm. daily. Thereafter we return to a schedule of 1.0 gm. twice a week, always giving PAS, 12.0 gm. daily, or INH, 4-6 mg. per kilogram daily, or both, throughout the period of streptomycin therapy. Antimicrobial therapy is sometimes discontinued when the patient is discharged from the hospital, provided no residual lesions are evident, though we have followed the tendency to give these medications for more prolonged periods. If there are residual lesions by x-ray film examination the drugs are always continued for varying periods following discharge, even though such lesions appear stable.

The types of thoracoplasty which we now perform, either alone or in conjunction with resection, rarely require postoperative measures to overcome paradoxical motion or to combat scoliosis, though one of my associates, Dr. Lawrence Lowell, has purposely performed extensive one-stage thoracoplasties on two or three occasions during the past year and has combated paradoxical motion by use of a plaster cast, as recommended by Trapp.¹³

Postoperative measures to prevent or relieve pulmonary atelectasis have not changed. They should be used regularly and conscientiously. The potential value of tracheostomy in patients with critically lowered respiratory reserve and those who fail adequately to eliminate bronchial secretions should always be kept in mind.

Following sub-total pulmonary resections we generally maintain water-seal drainage of the pleural cavity with one large intercostal drainage tube for an average period of 48 hours, the length of time being varied according to the amount of drainage and the persistence of air leaks. When air leaks are extensive at the conclusion of a resection, two drainage tubes may be used, as is also generally the case following decortications. In the absence of significant air leaks we occasionally close the chest wall without drainage. Drainage is not established following total pneumonectomy unless there has been empyema present. Under such circumstances we are likely to perform concomitant thoracoplasty, place a large intercostal tube posterolaterally for drainage and a small polyethylene tube anteriorly for introduction of irrigating solutions containing antibiotics or enzymes. Such a polyethylene tube has also proved of value in some cases of sub-total resection, to permit escape of air and for introduction of medications. When persistent air leakage prevents early obliteration of the pleural cavity constant strong suction may be all that is required. If this fails, consideration should be given to performing thoracoplasty, phrenic nerve crush or a second thoracotomy in order to suture any major leaks.

Following surgery we consider deep breathing and arm exercises important in order to recover maximum function.

DISCUSSION AND SUMMARY

Like others, we have practically abandoned the use of artificial pneumothorax, phrenemphraxis and primary thoracoplasty in the treatment of pulmonary tuberculosis. Most of the patients on our service who do not manifest adequate resolution of their disease under medical management, become candidates for pulmonary resection, unilateral or bilateral.

Pulmonary resection is preferred to collapse therapy because:

- 1) It is considered to offer a more definitive and permanent means of control.
- 2) It is generally more conserving of respiratory function.
- 3) It avoids the late complications of artificial pneumothorax and extra-pleural plombage.
- 4) It generally results in immediate sputum conversion.
- 5) Patients, usually, have a much shorter period of morbidity and can be rehabilitated earlier.
- 6) It permits a more rapid hospital turnover, reducing the bed shortage and permitting definitive treatment of a much larger number of patients during a specific period of time.
- 7) We believe that its wider use will materially reduce the number of readmissions due to reactivation and spread of disease.

- 8) Concomitantly there should be public health benefits if infectiousness is more readily and promptly controlled.
- 9) By reducing the length of therapy required for treating the individual patient the economic savings, to the patient and the State, should become of great magnitude.

I admit that we may be using resection therapy too widely. We may learn that the antimicrobial medications now available, and new ones which will doubtless be discovered, can obviate the need for much of the surgery which we now perform. I have tried to review the trends which the surgical treatment of pulmonary tuberculosis has shown in our hands and certainly in those of many others. We must, however, continually re-evaluate our position. I have not attempted to offer statistics concerning the results of treatment, feeling that they would not have much value, as yet, from the standpoints of numbers and of time. In another 10 years we may look back on this heyday of resection as we do now on that of pneumothorax therapy. For while time is said to heal all wounds, it must also wound all those who would continue to heal by the convictions of yesterday.

DISCUSION Y RESUMEN

Como otros hemos prácticamente abandonado el uso del neumotórax artificial, así como la toracoplastia primaria en tuberculosis pulmonar.

La mayoría de los enfermos de nuestro servicio que no demuestran adecuada resolución de la enfermedad bajo tratamiento médico, se convierten en candidatos a la resección pulmonar y sea uni o bilateral.

La resección pulmonar se prefiere en lugar del colapso por:

- 1) Que se considera que ofrece un medio más definitivo y permanente de control.
- 2) Generalmente conserva más la función respiratoria.
- 3) Evita las complicaciones tardías del neumotórax artificial y del plomaje extrapleural.
- 4) Generalmente se logra la inmediata conversión de los esputos.
- 5) Los enfermos tienen un período de morbilidad más corto y se pueden rehabilitar más pronto.
- 6) Permite una renovación más rápida de enfermos en el hospital, disminuyendo así la escasez de camas y permitiendo tratamiento definitivo a mucho mayor número de enfermos en un determinado tiempo.
- 7) Creemos que su uso más amplio reducirá materialmente el número de readmisiones debidas a la reactivación de la enfermedad.
- 8) Al mismo tiempo habrá beneficios para la salubridad pública si-al comunicabilidad es más prontamente controlada.
- 9) Disminuyendo la duración del tratamiento requerido para el enfermo individual la economía tanto para el enfermo como para el gobierno debe ser muy considerable.

Admito que podríamos estar usando la resección demasiado ampliamente.

Podríamos aprender que la medicación antimicrobiana hoy obtenible y la que sin duda habrá de descubrirse, pueden evitar el uso de mucha de-

la cirugía que ahora realizamos. He tratado de revisar las tendencias que el tratamiento de la tuberculosis ha mostrado en nuestras manos y por supuesto en las otros. Sin embargo, debemos reevaluar constantemente nuestra situación. No intento ofrecer estadísticas del resultado del tratamiento, porque creemos que no habrán de tener gran valor tanto por su número como por el tiempo. Dentro de otros 10 años veremos retrospectivamente hacia este entusiasmo por la resección como vemos ahora el que se tenía por el neumotórax. Porque si bien se dice que el tiempo cura todas las heridas, el tiempo también ha de herir a los que continúen tratando de acuerdo con las convicciones *delayer*.

RESUME

Comme les autres, l'auteur a pratiquement abandonné l'utilisation du pneumothorax thérapeutique, de la paralysie phrénique, et de la thoracoplastie dans le traitement de la tuberculose pulmonaire. La plupart des malades de son service pour qui un effacement suffisant des lésions n'a pas été obtenue au cours du traitement médical sont alors opérés par résection pulmonaire unilatérale ou bilatérale.

L'auteur préfère l'exérèse pulmonaire à la collapsio-thérapie parce que :

- 1) Elle réalise un moyen de traitement plus certain et plus durable.
- 2) Elle respecte généralement mieux la fonction respiratoire.
- 3) Elle met à l'abri des complications tardives du pneumothorax artificiel et du pneumothorax extra-pleural.
- 4) Elle détermine en général la suppression immédiate de l'expectoration bacillifère.
- 5) Dans l'ensemble, les malades ont besoin d'un traitement infiniment plus court et peuvent être plus rapidement réadaptés.
- 6) Elle permet un mouvement plus rapide d'hospitalisation, corrige l'insuffisance des lits, et rend possible un traitement complet d'une quantité beaucoup plus grande de malades pour une période déterminée.
- 7) L'auteur pense que l'utilisation plus étendue de l'exérèse permettra la réduction du nombre des ré-admissions dues à la rechute et à l'extension de la maladie.
- 8) Parallèlement on peut obtenir aussi un avantage au point de vue de la santé publique puisque l'infection est plus parfaitement et rapidement jugulée.
- 9) En réduisant le temps consacré au traitement pour chaque malade, on réaliserait une économie très importante à la fois favorable au malade et au pays.

L'auteur reconnaît que l'utilisation de l'exérèse est pratiquée trop largement. Il est possible que l'on se rende compte que les médications spécifiques que nous avons maintenant à notre disposition et celles qui vont certainement être encore découvertes permettront de supprimer une grande part de nos indications chirurgicales actuelles. L'auteur a essayé de passer en revue les tendances qu'il a pu décerner dans le traitement chirurgical de la tuberculose pulmonaire, d'après les cas qu'il a vus lui-même

et qui sont probablement comparables à ceux de beaucoup d'autres. Il est nécessaire de remettre en cause à chaque instant nos points de vue.

L'auteur n'a pas cherché à donner des statistiques concernant les résultats du traitement, pensant qu'elles ne peuvent avoir qu'une petite valeur actuellement, étant donné le nombre des cas et le temps écoulé. Il pense que dans quelque dix ans, nous aurons à reconsidérer notre proposition à faire des exérèses, exactement comme nous agissons maintenant au point de vue du traitement par le pneumothorax. Car si le temps a la réputation de guérir toutes les plaies, il risque également de causer quelque dommage à ceux que l'on voudrait continuer à guérir selon les procédés qui sont aujourd'hui démodés.

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Segmental Resection in Pulmonary Tuberculosis*

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Since 1949, segmental resections for pulmonary tuberculosis have been carried out on a large scale in the Thoracic Centre at Groningen. This follow-up investigation covers 285 patients who had undergone 300 segmental resections, at least six months preceding the date of re-examination. Until November 1, 1954, we performed 490 segmental resections for tuberculosis. No mortality. The first patient was operated upon on November 11th, 1949.

Segmental resection combined with lobectomy, and wedge excision alone, were not included in this series, because the lobectomy cases would probably have exerted an unfavourable influence on the results, while the wedge excision would have made the picture far too optimistic. We did, however, include the results of the combination of segmental resection with wedge excision, because the additional wedge excision is an operation of only minor importance.

During this period, a total of 781 pulmonary resections were carried out for tuberculosis. The numbers of the various types of resection per 100 operations are shown in Table II.

TABLE I
November 16th, 1949 — August 1st, 1953
285 Patients (300 simple segmental resections)
In the same period 781 pulmonary resections were performed in total

| | | | |
|---|---|-------------|----------|
| Males | 179 | 0-10 years | 3 |
| Females | 106 | 11-20 years | 35 |
| | | 21-30 years | 143 |
| | | 31-40 years | 73 |
| | | 41-50 years | 26 |
| | | 51-60 years | 5 |
| No mortality, either post-operatively or late | | | |
| Indications for segmental resection | Tuberculoma | Number | Per Cent |
| | Caseous foci | 44 | 14.6 |
| | Cavities (not suitable for non- surgical collapse ther.) | 168 | 56 |
| | Cavities (non-surgical collapse ther. failed) | 60 | 20 |
| | | 28 | 9.33 |
| | | 300 | |

The 300 segmental resections were carried out in 285** patients (Tables I and II). Twenty-five of them had bilateral operations. The results of

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(Results of a follow-up of 285 cases in which 300 segmental resections were carried out in the period November 16th, 1949—August 1st, 1953; closing date of follow-up: February 1, 1954)

**The patients came from the Beatrix-Oord Sanatorium at Appelscha (Dr. J. K. Kraan); the Military Hospital at Assen (Specialist in Pulmonary Diseases, Dr. J. K. Kraan); the Department for Pulmonary Diseases (Dr. N. G. M. Orie) of the Clinic for Internal Diseases, Groningen (Prof. Dr. F. S. P. van Buchem); the Public Sanatorium at Hellendoorn (Dr. H. Vos), and the Roman Catholic Sanatorium 'De Klokenberg' at Tilburg (Dr. C. Dijkstra).

TABLE II
Pulmonary resection for tuberculosis Thoracic Centre, Groningen

| | Pneumo- nectomy | Pleu- rectomy | Lobec- tomy | Lobec- tomy + segm. re- section | Segm. resection | Wedge excision |
|---------|--------------------|------------------|----------------|--|--------------------|-------------------|
| 1-100 | 61 | — | 37 | — | 2 | — |
| 101-200 | 50 | — | 36 | 1 | 13 | — |
| 201-300 | 30 | — | 29 | 3 | 38 | — |
| 301-400 | 17 | — | 36 | 4 | 43 | — |
| 401-500 | 21 | — | 29 | 4 | 44 | 2 |
| 501-600 | 10 | — | 18 | 6 | 65 | 1 |
| 601-700 | 9 | 3 | 20 | 4 | 58 | 6 |
| 701-800 | 12 | 1 | 27 | 4 | 55 | 1 |
| 800 | 210 | 4 | 232 | 26 | 318 | 10 |

the two operations are judged in 15 of these cases; this is not done for the 10 others, because in seven of these the second segmental resection was carried out later than August 1st, 1953, while in the remaining five cases the second operation was lobectomy or wedge excision.

Forty-nine of the 300 segmental resections were combined with wedge excision. The sex ratio of the 285 operation cases was: male 179, female 106. The age distribution is given in Table I. As it is our principle to operate only on quiet phthisic foci, which have not healed under bed rest and antibiotics, the great frequency of patients between 20 and 30 is not remarkable.

It must always be considered whether pneumothorax is indicated. At present this is not often carried out in our centre.

When it is a question of choosing between surgical collapse therapy and segmental resection, we prefer the latter, because thoracoplasty, apart from its mutilating nature, is at least as serious an operation. It is an important factor that in thoracoplasty the main focus is not removed, and also that the results of segmental resection are better, both as regards function and sputum conversion. The scheme of treatment in the sanatoria has been modified somewhat since November 1949, due to the introduction of the antibiotics and a better understanding of their action. At present the following is our line of conduct:

- (1) The drugs are always given in combination during the rest course (para-aminosalicylic acid, streptomycin, isoniazid INH), in order to obviate resistance.
- (2) The following combinations are used:
 - (a) PAS 10 g./day by mouth + streptomycin intramuscularly three times weekly 0.5 g., for three months at a stretch.
 - (b) INH by mouth 4 mg./kg./day + streptomycin intramuscularly, 0.5 g. three times per week, usually for a period of 2-3 months.
 - (c) INH by mouth 4 mg./kg./day + PAS 10 mg./day by mouth, for about three months at a stretch.

The three combinations mentioned may be used successively.

Orie prefers combination *a* in fibrocaseous foci, and combination *b* in recent foci.

He does not give more than 1 kg. PAS, 30 g. streptomycin and 20 g. INH.

Indications for Segmental Resection

- (1) *Solitary or scattered tuberculoma-like foci.* There are various conceptions of "tuberculoma." Our notion of tuberculoma is a round, sometimes slightly ovoid, caseated focus, varying in size from a bean to an apple. These encapsulated processes arise because the patient cannot produce sufficient resistance to overcome the process completely, but still enough to prevent further spread.

If the tuberculoma is completely quiescent—as manifest by calcification—resection is not strictly necessary, but a regular check-up is sufficient.

In all other cases resection of the tuberculoma is the only adequate and safe method of treatment because of the danger of bronchogenic dissemination. In some cases operation is decided upon on account of the uncertain diagnosis, although the process seems quiescent.

- (2) *Limited non-cavitation processes* which do not heal under conservative treatment. The natural resistance of the patient is an important factor when considering whether resection must be employed. When the past history shows several relapses and a high familial incidence, we are less inclined to operate.
- (3) *Cavitation processes*
 - (a) One or more cavitation processes, not healing under conservative treatment and less suitable for non-surgical collapse therapy. Here we are thinking of cavities in the apical segment of the lower lobe and the hilus, which, as we know from experience, react poorly to collapse. The thick-walled cavity and the flooded one are also not suitable for intrapleural pneumothorax.
 - (b) One or more cavitation processes, not healing by conservative treatment and non-surgical collapse therapy.

Overholt, Woods and Wilson make a distinction between primary and secondary indications, depending on whether another method of treatment than bed rest or antibiotic therapy has been carried out previously. Only the last-mentioned indication is to be considered as secondary in this respect; the other three are primary. As bronchiectasis is either the result of a healed tuberculous process (and is then to be included among the ordinary cases of bronchiectasis), or is accompanied by tuberculous foci or cavities, we do not think it necessary to introduce a separate indication for so-called tuberculous bronchiectasis.

Table I gives a survey of the frequency of the various indications. Among these 300 indications there were three in whom surgical collapse treatment had been carried out previously: one had thoracoplasty and two had extrapleural pneumothorax.

The Pre-Operative Treatment

The usual precautions in connection with chest operations are observed in segmental resection. Patients are given pre-operatively high doses of vitamins; urine is made alkaline in connection with blood transfusions which may be necessary, and the teaching of respiratory exercises is started at least one week before the operation.

The absolute rest course is interrupted before the operation in order to improve the patient's general condition: one month pre-operatively he is allowed to get up and about for 15 minutes twice daily; after some days this is increased to 30 minutes twice daily.

The pre-operative administration of antituberculous antibiotics is important. It is our practice to give 1 gram of streptomycin daily for a week before operation. In order to suppress common infections, we give about 500,000 U. penicillin one or two days prior to the operation.

The Operation

All patients are operated upon in the lateral position, under intratracheal anesthesia with pentothal, nitrous oxide and curare. The thorax is opened with a Crafoord incision or a posterolateral one, followed by subperiosteal resection of the fifth or sixth rib. As a matter of routine the bronchus is searched for first, either via the ventral hilus or the interlobular fissure. The next step is to find the artery and to ligate it. The veins are only ligated in so far as is necessary in the removal of the segment. A clamp is placed on the bronchus, and distally of this clamp the bronchus is severed in stages as far proximally as possible, and closed after each stage with terminal linen sutures. The bronchial stump is always buried carefully, either in the pulmonary tissue or with a purse-string suture under the pleura. In order to retain sufficient pleura for the bronchial stump, the dissection should be done not too far centrally but more peripherally.

The rough pulmonary surface is always pleuralized by suturing the pleural edges of the residual segments. In our opinion, complications, exudations and adhesions are limited in this way. After every segmental resection a single drain is introduced, reaching up to the top of the thorax and emerging at the lowermost point of the pleural cavity in the dorsal axillary line.

The suction pressure exerted on the drain is usually—16 cm. H_2O ; it is removed after three to five days.

The After-Treatment

The patient is kept completely supine for the first 24 hours after the operation, and oxygen is administered. Streptomycin is given for two to three weeks. Penicillin is usually stopped one week after the operation. Coughing is considered of high importance. In order to make this less painful, we make full use of analgesics. On the day of operation novocaine is administered via the intravenous drip instituted previously. All pa-

tients operated upon remain in the sanatorium for after-treatment for at least six months and in most cases for seven to eight months.

TABLE III
300 Resected lung segments for tuberculosis

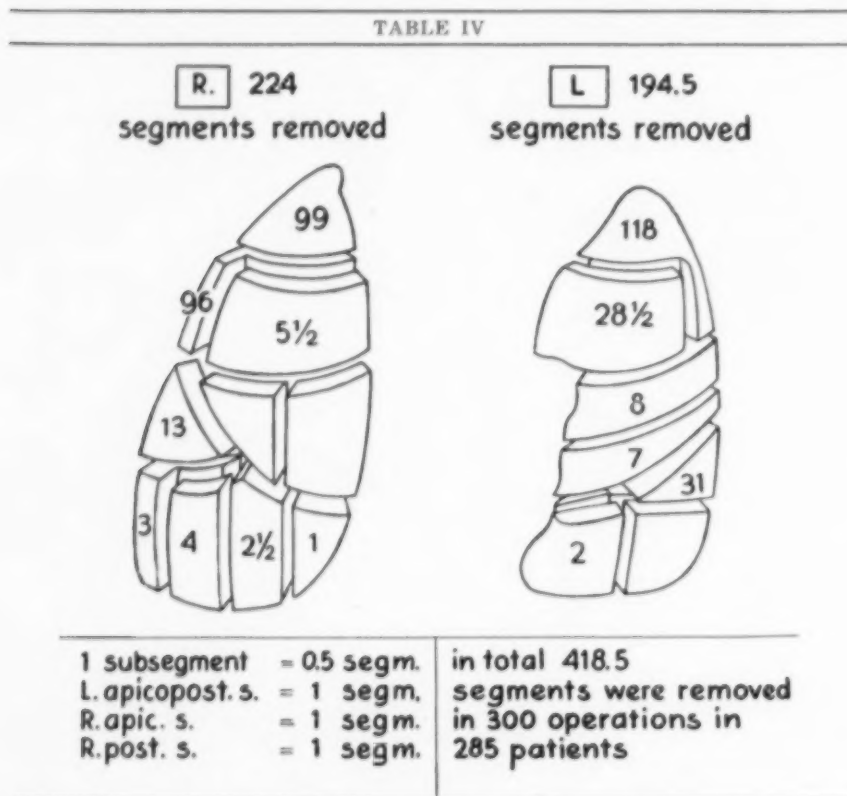
| R | 134 | L | 166 |
|-------------------------------------|------------|-----------------------------------|------------|
| <i>Upper lobe</i> | <i>114</i> | <i>Upper lobe</i> | <i>132</i> |
| anterior segment | 5 | anterior segment | 6 |
| subsegment anterior segment | 1 | subsegmental anterior segment | 3 |
| apical segment | 19 | apicoposterior segment | 85 |
| posterior segment | 15 | apical subsegment | 8 |
| apicoposterior segment | 74 | posterior subsegment | 8 |
| | | apicoposterior + anterior segment | 14 |
| <i>Middle lobe</i> | <i>0</i> | | |
| <i>Lower lobe</i> | <i>12</i> | <i>Lingula</i> | <i>4</i> |
| apical segment | 6 | superior segment | 1 |
| anterobas. segment | 1 | lingual + anterior segment | 3 |
| cranial subsegment anterior segment | 1 | | |
| laterobas. segment | 2 | <i>Lower lobe</i> | <i>23</i> |
| posterobas. segment | 1 | apical segment | 19 |
| latero + posterobas. segment | 1 | subsegment apical segment | 2 |
| all bas. segment | 1 | anterobas. segment | 2 |
| <i>Upper + Lower lobe</i> | <i>7</i> | <i>Upper + Lower lobe</i> | <i>11</i> |
| apical + posterior segment upper | | apicoposterior segment upper lobe | |
| lobe + apical segment lower lobe | 6 | + apical segment lower lobe | 7 |
| posterior segment upper lobe + | | anterior + apicoposterior segment | |
| apical segment lower lobe | 1 | upper lobe + apical segment | |
| | | lower lobe | 4 |

In our series of 300 segmental resections, 418.5 segments were removed altogether, of which 224 were on the right and 194.5 on the left. A subsegment is counted as half a segment; the wedge excisions were left out of consideration. The apical and posterior segments of the right upper lobe count each as one segment, the apical and posterior subsegment of the left upper lobe as a subsegment and the apicoposterior segment as one segment (Tables III and IV give a survey of the number of segments removed). The tuberculous foci suitable for segmental resection are situated mainly in the craniodorsal segments and also fairly frequently in the anterior segment of the left upper lobe and the apical segment of the lower lobe.

Complications and Results

It is often difficult to describe what is meant by the term "complication." We do not call a paresis of the diaphragm due to unavoidable post-operative adhesions a complication, in contrast to a diaphragmatic paralysis—practically always caused by a lesion of the phrenic nerve—which we do consider as such. It is also difficult to say when pleurisy must be called a complication. We took as a criterion the necessity—if any—of thoracic aspiration after the removal of the drain. The difference between pulmonary collapse and atelectasis is based on the extra or intrabronchial character of the causes leading to the falling in of the lung. Pulmonary collapse is radiologically characterized by displacement of the mediastinum to the healthy side and by the presence of fluid or air as an extrabronchial

TABLE IV



factor of the collapse. In atelectasis the mediastinum is drawn towards the diseased side. The difference between the two is not always easy to recognize, but is of great significance from a therapeutic point of view.

The post-operative course of 127 segmental resections (42.3 per cent) was more or less complicated (78 serious and 49 non-serious complications). Table V gives a survey of the various complications.

Apart from perception deafness, bronchopleural fistula, empyema, re-activation and spread of tuberculosis, complications are not serious and satisfactory treatment is usually possible. Table VI shows the incidence and treatment of bronchopleural fistula. These low figures should not lead to the conclusion that thoracoplasty gives better results than re-resection. This table does, however, demonstrate the favourable effect of thoracoplasty on bronchopleural fistula.

Table VI further shows the incidence and treatment of local encapsulated and diffuse empyemas. The diffuse empyemas were always combined with bronchopleural fistula.

In most cases of bronchopleural fistula with empyema there were, immediately following operation, difficulties concerning the expansion of the lung, without a bronchopleural fistula being demonstrable, however.

TABLE V
127 POST-OPERATIVE COMPLICATIONS

major 78
minor 49

300 Segmental Resections for Tuberculosis
(November 16th, 1949—August 1st, 1953)
as per February 1st, 1954
no mortality

A. PULMONARY

| | Number | Per Cent | | Number | Per Cent |
|----------------------------|--------|----------|----------------------------|--------|----------|
| Haemorrhage | 11 | 3.6 | Reactivation | 9 | 3 |
| Pneumothorax | 11 | 3.6 | (a) homolateral | | 7* |
| (a) of short duration | 7 | | (b) heterolateral | | 2** |
| (b) tension pneumoth. | 4 | | Spread | 24 | 8 |
| Pleuritis (reactive) | 33 | 11 | (a) homolateral | | 21*** |
| Collapse | 5 | 1.6 | (b) heterolateral | | 3**** |
| Atelectasis | 30 | 10 | Temporarily positive | | |
| (a) of short duration | 28 | | sputum | 2 | 0.6 |
| (b) permanent, partial | 2 | | Ulceration bronchial | | |
| Slow expansion | 11 | 3.6 | stump | 3 | 1 |
| (a) cured conserv. | 10 | | T. B. bronchitis | 2 | 0.6 |
| (b) thoracoplasty | | | Post-operative stenosis | | |
| necessary | 1 | | main bronchus | 1 | 0.3 |
| Bronchopleural fistula | 6 | 2 | Paralysis diaphragm. | 7 | 2.3 |
| Empyema | 8 | 2.6 | Thrombosis pulm. art. | 1 | 0.3 |
| (a) diffuse | 6 | | | | |
| (b) partial | 2 | | | | |
| *) | | | 5 months post-operatively | 2 | |
| 2 months post-operatively | 2 | | 7 months post-operatively | 1 | |
| 6 months post-operatively | 1 | | 8 months post-operatively | 2 | |
| 7 months post-operatively | 1 | | 9 months post-operatively | 1 | |
| 17 months post-operatively | 2 | | 10 months post-operatively | 1 | |
| 24 months post-operatively | 1 | | 12 months post-operatively | 2 | |
| **) | | | 14 months post-operatively | 1 | |
| 1 month post-operatively | 1 | | 16 months post-operatively | 1 | |
| 5 months post-operatively | 1 | | 18 months post-operatively | 1 | |
| ***) | | | 20 months post-operatively | 2 | |
| 2 months post-operatively | 1 | | 27 months post-operatively | 1 | |
| 3 months post-operatively | 1 | | ****) | | |
| 4 months post-operatively | 4 | | 2 months post-operatively | 2 | |
| | | | 8 months post-operatively | 1 | |

B. CARDIOVASCULAR

| | Number | Per Cent | | Number | Per Cent |
|----------------------------|--------|----------|--------------------|--------|----------|
| Heart complications | 2 | 0.6 | Thrombosis leg | 5 | 1.6 |
| (a) irregular pulse | 1 | | Pulmonary embolism | 5 | 1.6 |
| (b) paroxysmal tachycardia | 1 | | | | |

C. NEUROLOGICAL

| | Number | Per Cent | | Number | Per Cent |
|---------------------|--------|----------|----------------|--------|----------|
| Horner | 3 | 1 | Plexus arm | 4 | 1.3 |
| Perception deafness | 3 | 1 | (operat. side) | | |
| (streptomycin) | | | | | |

D. OTHER

| | Number | Per Cent | | Number | Per Cent |
|------------------------|--------|----------|-------------------|--------|----------|
| Progressive disease | 2 | 0.6 | Subcut. emphysema | 4 | 1.3 |
| elsewhere (renal t.b.) | | | Wound supuration | 1 | 0.3 |
| | | | (ligatures) | | |

TABLE VI
Complications of segmental resection.

| <i>Results of treatment</i> | |
|-------------------------------------|---|
| <i>Bronchopleural fistula</i> | 6 |
| Cured: thoracoplasty | 4 |
| Still under treatment: resection | 2 |
| <i>Empyema</i> | 8 |
| (a) partial | 2 |
| Cured: thoracoplasty | 1 |
| conserv. treatm. | 1 |
| (b) diffuse | 6 |
| Cured: thoracoplasty | 4 |
| Still under treatment: re-resection | 2 |

In one case the bronchopleural fistula arose a fortnight after the operation; in the other five cases empyema was diagnosed once after one month, once after two months, twice after three months and once after four months. Inadequate technique was presumably an important factor in the first case (No. 556), in contrast to the other cases in which probably an important place must be attributed to tuberculous infection of the bronchial stump and (or) the pleural cavity. Incomplete expansion of the lung greatly promotes the development of empyema.

The formation of encapsulated empyemas is probably only based on spread of the tuberculous infection, because one developed seven months and the other two years after the operation.

Table VII gives the incidence and course of reactivation and spread of the pulmonary tuberculosis. These complications especially annul the results of segmental resection. This table once more demonstrates that tuberculosis is a generalized infection and is never removed completely by resection therapy. We believe that the improvement of the results is

TABLE VII
Complications of segmental resection

| <i>Results of treatment</i> | |
|-----------------------------|----|
| <i>Reactivation</i> | 9 |
| (a) <i>homolateral</i> | 7 |
| Re-resection | |
| still under treatment | 5 |
| Conserv. | |
| still under treatment | 2 |
| (b) <i>heterolateral</i> | 2 |
| Conserv. | |
| still under treatment | 2 |
| <i>Spread</i> | 24 |
| (a) <i>homolateral</i> | 21 |
| Cured | 8 |
| re-resection | 5 |
| conserv. treatm. | 3 |
| Still under treatment | 13 |
| after re-resection | 2 |
| after thoracoplasty | 1 |
| conserv. treatm. | 10 |
| (b) <i>heterolateral</i> | 3 |
| Cured | 3 |
| thoracoplasty | 1 |
| conserv. treatm. | 2 |

mainly a matter of prevention and combating of spread and reactivation of tuberculosis.

These complications may arise shortly after operation or much later. Homolateral reactivation occurred twice after two months, once after six months, once after seven months, twice after 17 months and once after 24 months. Heterolateral reactivation arose once consequent upon the operation and once after five months.

Homolateral spread was observed once after two months, once after three months, four times after four months, twice after five months, once after seven months, twice after eight months, once after nine months, once after 10 months, twice after 12 months, once after 14 months, once after 16 months, once after 18 months, twice after 20 months and once after 27 months. Heterolateral spread was diagnosed twice after two months and once after eight months.

This proves that operative trauma is not the decisive factor for spread or reactivation of the infection.

Sputum conversion see Table VIII. The second and third columns show the number of cases in which good results were obtained after supplementary conservative or surgical treatment alone.

TABLE VIII
Sputum conversion 285 patients
(300 segmental resections)

| Sputum negative 277 = 97.1 per cent | | |
|-------------------------------------|------------------------------|------------------------------|
| Immediately after S. R. | After complem. cons. therapy | After complem. surg. therapy |
| 253 | 11 | 13 |
| | | thoracpl. re-resection 2 11 |
| 88.7 per cent | 3.8 per cent | 4.5 percent |

It must, however, be remarked that not all patients with negative sputum are cured, because some of them suffer from spread of the process or reactivation of old lesions.

Table IX shows that the results in cavitation processes are less satisfactory than in tuberculomas or caseated foci, when the cases of sputum conversion are classified according to the indications.

TABLE IX
Sputum conversion and indications for segmental resection
(300 resections)

| Sputum negative 292 | | | | | | | Sputum positive 8 |
|--|-----|-------------------------|----------|------------------------------|------------------------------|--------------|-------------------|
| Indication | | Immediately after S. R. | | After complen. cons. therapy | After complen. surg. therapy | | |
| | | Number | Per Cent | | thoracopl. | re-resection | |
| Tuberculoma | 44 | 39 | 88.6 | 1 | 2 | 2 | 0 |
| Caseous foci | 168 | 155 | 92.2 | 7 | 0 | 3 | 3 |
| Cavities | 88 | | | | | | |
| (a) not suitable for non-surg.collapse therapy | 60 | 50 | 83.3 | 3 | 0 | 3 | 4 |
| (b) non-surg. collapse therapy | 28 | 24 | 85.7 | 0 | 0 | 3 | 1 |

Table X proves that the number of patients with negative sputum decreases as time goes on. This is exclusively due to reactivation and spread of the tuberculosis.

TABLE X
Sputum conversion and observation time
285 patients (300 segmental resections)

| Sputum negative 277 | | | | | Sputum positive 8 | |
|---------------------|-----|------------------------|----------------------------|----------------------------|-------------------|---|
| Observation time | | Immediately after S.R. | After compl. cons. therapy | After compl. surg. therapy | | |
| | | | | thoracopl. | re-resection | |
| 4 years | 2 | 2 | 0 | 0 | 0 | 0 |
| —3 years | 33 | 26 | 3 | 1 | 3 | 0 |
| 3 —2 years | 88 | 75 | 6 | 1 | 4 | 2 |
| 2 —1 years | 110 | 101 | 2 | 0 | 3 | 4 |
| 1 year—6 months | 52 | 49 | 0 | 0 | 1 | 2 |

Table XI shows the number who have resumed their work completely or partially or will be able to do so in the near future. The future, as regards fitness for work, remains problematic for 9.1 per cent. All who were not yet completely fit for work on the date of re-examination (February 1, 1954), will—apart from unexpected circumstances—resume their work completely in the near future.

TABLE XI
Segmental resection t.b.c.
285 patients
per February 1st, 1954

| Able to work: | | | |
|------------------------|---------------|----------------------------|-----------------|
| 100% fully active life | half-time job | at work in the near future | not yet decided |
| 199 | 15 | 14 | 26 |
| 69.7 per cent | 5.2 per cent | 15.7 per cent | 9.1 per cent |

Investigation of pulmonary function has shown that after segmental resection the average loss of vital capacity is 348 ml., of maximum respiratory minute volume 5.7 l., of C.U.S. (Tiffeneau) nil, of vital capacity and oxygen uptake on the operated side 5.3 per cent and 6.2 per cent respectively.

When the results of the pulmonary function tests agree with these values, we speak of a normal functional loss caused by the operation. When the values have fallen unduly, the loss is considered too great (Table XII).

TABLE XII
Pulmonary function tests at least six months after segmental resection for tuberculosis in 222 of the 285 patients.

| Normal loss | | Loss of function too great | |
|-------------------|----|----------------------------|---|
| 173 | | 49 | |
| 77.9% | | 22% | |
| Paresis diaphr. | 12 | Slow expansion | 3 |
| Paralysis diaphr. | 7 | Empyema + br. pl. fistula | 5 |
| Pleuritis | 7 | Thrombosis pulm. art. | 2 |
| Pneumoth. | 3 | Operative damage | |
| Atelect. | 2 | pulm. art. | 1 |
| Collapse | 1 | Cause ?? | 8 |
| Haemothor. | 1 | | |

Causes for too great a loss were: paresis of the diaphragm in 12 cases and paralysis of it in seven. Pleurisy was a harmful factor in seven, post-operative pneumothorax three, atelectasis two, pulmonary collapse once, hemothorax once, delayed expansion three and empyema with bronchopleural fistula five times. In two the cause of the bad pulmonary function was thrombosis of the pulmonary artery, and once operative trauma of this artery. In eight no cause was found for the abnormal reduction in pulmonary function. A remarkable feature is that in four of post-operative hemorrhage the pulmonary function improved following streptokinase/streptodornase treatment.

TABLE XIII
300 Segmental resections
November 16th, 1949—August 1st, 1953
Results of operation, and observation time.

| | | | Good 243 81 per cent | Moderate 18 6 per cent | Bad 39 13 per cent |
|---|---------------|-----|-------------------------|---------------------------|-----------------------|
| 4 | 4 years | 2 | 2 (100) | 0 | 0 |
| 3 | —3 years | 33 | 22 (66.6) | 4 | 7 (21.2) |
| 3 | —2 years | 89 | 71 (79.7) | 4 | 14 (16.6) |
| 2 | —1 years | 121 | 98 (80.9) | 9 | 14 (11.5) |
| 1 | year—6 months | 55 | 50 (90.9) | 1 | 4 (7.2) |

All bilateral resections were good except in one with spread after his second S.R. The first S.R. had been recorded as 'good', the second as 'bad' (Nos. 701 and 762).

Table XIII gives the total results of segmental resection. The result is considered moderate when the main object of the operation, i. e., the returning to useful life of a healthy person with negative sputum, is indeed attained, but that complications not requiring surgical treatment have affected the general or local state of the patient to a greater or lesser degree. Moderate results were caused seven times by paralysis of the diaphragm, five times dyspnoea arose when the patient did somewhat heavier work, and three times perception deafness occurred due to streptomycin.

Tension pneumothorax, hemothorax, unsatisfactory expansion of the lung, encapsulated empyema and transient positive sputum were also of importance, without an explanation being found for it.

We speak of *bad* results when the main purpose of segmental resection has not been reached, or when the general or local condition is seriously affected due to complications. Spread or reactivation was in 32 cases the cause of failure of segmental resection (in one both spread and reactivation), six times diffuse empyema and once encapsulated empyema which was treated by thoracoplasty. The latter operation was also necessary in one patient because of insufficient expansion of the lung. The moderate results were largely due to faulty technique. The bad results were largely due to spread or reactivation after the tuberculous pulmonary process.

Even more than is the case with sputum conversion, the results in patients with cavities are worse than in those with caseated foci and tuber-

culomata. Table XIII shows that just as in sputum conversion the results of segmental resection become less good with increasing duration of the observation period. It seems therefore premature to pass a definite judgment on the value of segmental resection.

Table XIV gives the number of patients cured after segmental resection alone, or after this operation combined with supplementary conservative or surgical treatment. The prognosis was doubtful to bad for only 1.4 per cent of those not yet cured.

TABLE XIV
Follow-up of 285 patients
(300 segmental resections for tuberculosis per February 1st, 1954)

| Cured 262 (92 per cent) | | | Still under treatment 23 (8 per cent) | |
|----------------------------|--|--|--|---------------------------------|
| by S.R. alone | by S.R. with supplement- ary conserv. treatment | by S.R. with supplement- ary surgical treatment | Prognosis doubtful to favourable | Prognosis doubtful to bad |
| | | Re-resection 5 Thoracopl. 4 | | |
| 246 | 7 | 9 | 19 | 4 |
| 86.3 per cent | 2.4 per cent | 3.1 per cent | 6.6 per cent | 1.4 per cent |

SUMMARY AND CONCLUSIONS

1. The post-operative course of 300 segmental resections in 285 patients with tuberculoma, localized caseated foci or cavitational processes was complicated in 127 (42.3 per cent). Most of the complications were of an innocent or transient nature.
2. In three cases perception deafness occurred consequent upon the routine streptomycin treatment (maximally 20 g.). Apart from two encapsulated empyemata which were cured, six diffuse empyemata with bronchopleural fistula were observed. Four of them recovered after thoracoplasty, and two are still under treatment after re-resection. Reactivation of the pulmonary tuberculosis occurred in nine, spread in 24 patients. All cases of reactivation are still under treatment. Eleven with spread have already recovered, either after conservative or after supplementary surgical treatment.
3. At the follow-up examination 97.1 per cent of patients had negative sputum. The results were better in the cases of caseated foci and tuberculomata than in cavitational processes. The percentage of negative sputum decreases somewhat with increasing duration of the observation time.
4. More than 90 per cent have resumed their work or will do so in the near future.
5. In nearly 80 per cent loss of pulmonary function was no greater than was to be expected after segmental resection.
6. Of those who had undergone segmental resection 92 per cent were

cured at the time of re-examination, which was at least six months after the operation. For only 1.4 per cent the prognosis was doubtful to bad.

- (7) The final result of segmental resection was good in 81 per cent of cases. The results were here also better for tuberculomata and caseated foci than for cavitational processes. The number of good results decreases with increasing time of observation.
- (8) Up to February 1, 1954 there was no fatal case among the series discussed, either post-operatively or during follow-up.

RESUMEN

1. La evolución postoperatoria de 300 resecciones segmentarias en 285 enfermos con tuberculoma, focos localizados caseosos o procesos cavitarios, se complicó en 127 (42.3 por ciento). La mayoría de las complicaciones fué de naturaleza transitoria e intrascendentes.

2. En tres casos ocurrió sordera de percepción después del uso de rutina de estreptomycin (máximo 20 grms.). Fuera de dos empiemas encapsulados que se curaron, se observaron seis empiemas difusos con fistula broncopleurales. Cuatro de ellos se recuperaron después de toracoplastia y dos están aún bajo tratamiento después de re-resección. La reactivación de la tuberculosis pulmonar ocurrió en nueve y la diseminación en 24 enfermos. Todos los casos de reactivación están aún bajo tratamiento. Once casos con reactivación se han recuperado ya sea por medios conservadores o después de tratamiento quirúrgico suplementario.

3. Según la prosecución de los enfermos, 97.1 de los enfermos tuvieron esputos negativos. Los resultados fueron mejores en los casos de focos caseosos y en los tuberculomas que en los procesos excavados. El porcentaje de esputos negativos decrece algo al aumentar el tiempo de observación.

4. Más del 90 por ciento han vuelto a su trabajo o lo harán en el futuro próximo.

5. En casi el 80 por ciento la pérdida de la función pulmonar no fué mayor de lo esperado después de resección segmentaria.

6. De los que sufrieron resección segmentaria, 92 por ciento estaban curados al ser re-examinados, lo que fué por lo menos seis meses después de la operación. Solamente para el 1.4 por ciento el pronóstico fué dudoso o malo.

7. El resultado final de la resección segmentaria fué bueno en 81 por ciento de los casos. Los resultados fueron también mejores para los tuberculomas y los focos caseosos que para los excavados. El número de buenos resultados disminuye al aumentar el tiempo de la observación.

8. Hasta el 1.º de Febrero de 1954, no ha habido un caso fatal en la serie que se discute, ya sea postoperatoriamente o durante la prosecución.

RESUME

1. Les suites opératoires de 300 résections segmentaires pratiquées chez 285 malades pour tuberculome, foyer caséeux localisé, ou lésion

cavitaire, furent l'objet de complications chez 127 d'entre eux (42,3%). La plupart de ces complications furent bénignes et éphémères.

2. Dans trois cas, une surdité apparut, à la suite du traitement systématique par la streptomycine. En dehors de deux pleurésies purulentes enkystées, qui furent traitées, on observa six cas de pleurésie purulentes avec fistule bronchopleurale. Quatre d'entre elles guérissent après thoracoplastie et deux sont encore actuellement en traitement après une nouvelle exérèse. Une rechute de la tuberculose pulmonaire survint chez neuf malades et un ensemencement chez 24. Tous les cas de rechutes sont actuellement en cours de traitement. Onze cas qui avaient eu en des propagations à distance ont complètement guéri, soit par le simple traitement médical, soit après une nouvelle intervention chirurgicale.

3. Lors de l'examen complet, 97,1% des malades avaient négativé leur expectoration. Les résultats furent supérieurs dans les cas de foyer caséux et de tuberculome à ceux où il existait une cavité. Il y eut une certaine diminution du pourcentage des expectorations négatives, à mesure qu'augmenta le temps d'observation.

4. Plus de 90% des malades ont repris leur occupation professionnelle ou sont sur le point de le faire.

5. Dans près de 80% des cas, on n'a pas eu à déplorer une diminution de la fonction pulmonaire supérieure à ce qu'on peut attendre à la suite d'une résection segmentaire.

6. Parmi les malades qui ont subi une résection segmentaire, 92% se montrèrent guéris lors d'un nouvel examen qui fut pratiqué au moins six mois après l'opération. Ce n'est que dans 1,4% des cas que le pronostic était douteux ou mauvais.

7. Le résultat final des résections segmentaires se montra favorable dans 81% des cas. Les résultats là aussi furent meilleurs pour les tuberculomes et les foyers caséux que pour les foyers cavitaires. La quantité des résultats favorables diminua à mesure qu'augmentait le temps d'observation.

8. A la date du 1er février 1954, il n'y eut aucune mortalité parmi les cas qui sont étudiés, soit après l'opération, soit au cours de la surveillance consécutive.

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Intrapleural Enzymatic Debridement With Tryptar

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Of the various complications which may occur as a result of pulmonary tuberculosis, thoracic empyema has always been one of the most difficult to successfully combat. All physicians experienced in the treatment of this condition can recall the numerous aspirations, pleural lavage and drainage procedures frequently required and the usually futile attempts to obliterate the infected pleural space and re-expand the lung.

Sterilization of the space became possible in certain instances with the increased use of the various antibiotic drugs. This procedure per se, however, could not usually produce a cure because of the inability of the lung to re-expand as a result of the thick, fibrous membrane holding it captive. Extensive thoracoplasty was often resorted to in an effort to appose the chest wall to the unexpandable lung and thereby obliterate the empyema space. Surgical decortication of the inflammatory peel was applied to cases of tuberculous fibrothorax following the successful results obtained by this form of treatment when used in non-tuberculous conditions. The results with decortication in the tuberculous group were less successful than in non-tuberculous cases because of the inability to sterilize the empyema space preoperatively.

Reiser, Roettig and Curtis¹ approached this problem by utilizing the pancreatic enzyme trypsin as a debriding agent. This substance was injected into the empyema cavity in an effort to digest the shaggy, pyogenic membrane by its proteolytic action, hoping the raw infected surface thereby exposed might be made amenable to treatment by antibiotic drugs. By controlling the infection, decortication could be made a safer and more successful procedure. Of the initial six cases of mixed tuberculous empyema reported by these authors, two obtained a complete cure of empyema using trypsin alone, while the others showed a decrease in viscosity and clearing of the fluid. Positive fluid became negative in four instances. An additional 10 cases were reported by Roettig, Reiser, Habeeb and Mark² in March, 1952, with similar good results.

Action of Tryptar. These workers^{1, 2} have studied the action of trypsin *in vitro* and *in vivo* and have noted the rapid liquefaction of fibrin clots and decrease in viscosity of the empyema fluid. Crystalline trypsin injected intrapleurally in dogs causes prompt pleural effusion which resolves within one week leaving no detectable residual pleural reaction. It will also digest other dead tissue such as muscle, blood vessels, skin and fascia, but will not attack living cells. This is of considerable importance and denotes the relative safety in using trypsin as compared to the proteolytic enzymes of streptococcal origin against which the body has no

Material used in the study was tryptar, a pure crystalline trypsin, supplied by The Armour Laboratories.

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protective anti-enzyme. The fibrin and viscid nucleoprotein of the pyogenic membrane are readily digested leaving exposed a raw, clean pleural surface. Empyema fluid changes in character from a thick pus to a thin, watery, slightly turbid fluid which eventually becomes amber or straw-colored. Grossly bloody changes are noted after several days of treatment and indicate debridement of the inflammatory membrane and action of the trypsin on the exposed pleural surface.

In the majority of cases, pleural fluid becomes bacteriologically negative on smear and culture for acid-fast and other organisms. It is believed that trypsin in itself is not bactericidal but causes sterilization of the space through its debriding action by depriving bacteria of culture media needed for growth.

Side Effects. A histamine-like reaction has been noted when trypsin is administered parenterally. Transient temperature elevation and increase in the pulse rate occur. Slight hypotension may be noted. Administration of an anti-histaminic prior to the use of trypsin will protect against these manifestations. Pain may occur when trypsin comes in contact with the healthy pleural surface. No instance of severe sensitivity produced by the preparation has been noted.

Results obtained by Roettig, Reiser, Habeeb and Mark were so promising as to encourage other workers to employ this method in the treatment of empyema. Only one of their 17 cases could be classed as a complete failure. Six cases showed re-expansion of the lung using tryptar alone. In all of these cases, empyema had been present for a period of less than six months prior to treatment. In the remaining cases, success was measured in terms of rapid decrease in the viscosity of the empyema fluid, lysis of the pyogenic membrane and sterilization of the space. Some of these cases went on to complete cure through supplementary surgical procedures such as decortication. Results were more satisfactory in the non-tuberculous or mixed infections. Subsequent direct inspection of the pleura in five cases showed it to be clean and glistening. Viscosity of the empyema fluid decreased in all 17 cases and sterilization of the space was noted in 12 of the 13 instances in which organisms had been present prior to treatment. The average time required for this conversion was 10 days.

Although the occurrence of bronchopleural fistula was not noted following the use of trypsin, this eventuality must be kept in mind when enzymatic debridement is employed in the immediate postoperative period. Its use postoperatively should probably be withheld until bronchial healing has occurred. McCroskey and Hardin³ used tryptic debridement in the treatment of clotted hemothorax two weeks following spontaneous rupture of a syphilitic aneurysm of the ascending aorta. Thoracotomy was subsequently performed and revealed the point of rupture of the aortic aneurysm was sealed over by adherent lung. Trypsin had produced an effective lysis of the clotted hemothorax but apparently did not interfere with the reparative process between the lung and the ruptured aneurysm.

Following the lead of Roettig and his co-workers, the author was encouraged to use this method of treatment in certain instances of tuber-

culous, non-tuberculous and mixed infection empyema. The technique of treatment varied somewhat in the fact that an indwelling number 16 French catheter intercostal tube was used in most of the present cases. The tube was clamped for eight to 12 hours following instillation of the trypsin and was connected to a negative pressure suction apparatus when reopened. Patients were instructed to change position frequently. Benadryl, 50 mg., was given before each treatment and as required subsequently. The trypsin used was tryptar, a pure crystalline trypsin.

Case Reports

Case 1. F. M., a 31 year old white female, was seen on November 2, 1951, with left tuberculous empyema, the result of an unexpanded therapeutic pneumothorax. The patient had been under treatment for tuberculosis intermittently since 1947 with periods of sanatorium care, streptomycin and para-aminosalicylic acid, pneumothorax and aspirations of pleural effusion. Therapeutic pneumothorax had been instituted in July, 1950, and thin, clear pleural effusion was noted in October, 1950. The fluid remained thin and small in quantity until the fall of 1951. Left thoracentesis on November 8, 1951, yielded thick, yellow pus which was positive for acid-fast bacilli on smear and culture, but negative for other organisms. X-ray film at this time showed the left lung to be 50 per cent collapsed and held captive by a 3-4 mm. in-

FIGURE 1

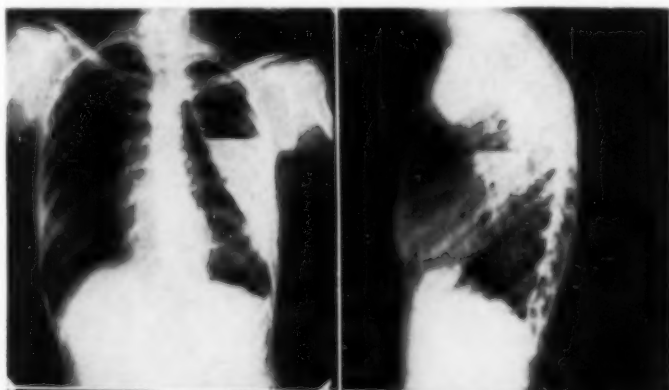


FIGURE 2

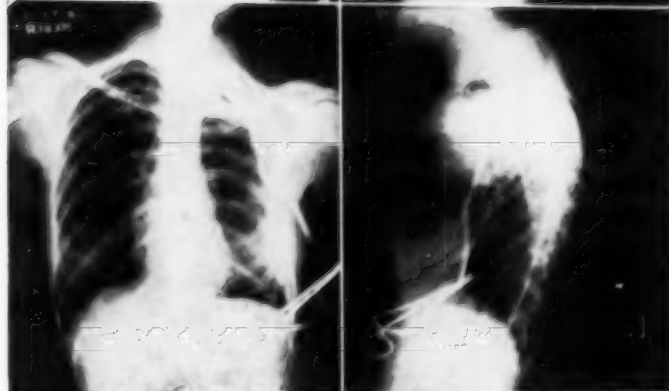


Figure 1—Case 1: Tuberculous empyema, left. Roentgenogram prior to treatment with tryptar. Figure 2—Case 1: Tuberculous empyema, left. Roentgenogram following second instillation tryptar. Intercostal tube in place.

flammatory peel. The pneumothorax space was approximately 50 per cent filled with fluid. Following admission to the Tampa Municipal Hospital a number 16 French catheter was inserted into the left third interspace for the purpose of closed drainage and 250 cc. of pus were evacuated after which 250,000 units of tryptar dissolved in 25 cc. of Sorensen's phosphate buffer solution were instilled through the tube which was then clamped off for a 12 hour period. This procedure was repeated daily for four days. Upon each occasion, the chest tube was connected to the suction apparatus for several hours prior to instillation of tryptar. Thick coagulum and proteolytic debris could be noted returning through the tubing on each occasion and by the end of 48 hours the thick pus had changed in consistency to a thin, white, turbid fluid. Long membranous strands were found in the bottom of the drainage bottle representing desquamated inflammatory peel. A pinkish tinge to the fluid was noted following the third instillation. X-ray film at the end of 48 hours showed the lung to be approximately 90 per cent expanded. Six days following the first course of 1,000,000 units, a second course was given, again consisting of four daily administrations of 250,000 units each. This was done in an effort to obliterate a small residual space. The intercostal tube was removed. Smear and culture for acid-fast bacilli were negative on the 10th day following the initial instillation of tryptar.

Since treatment, the lung has remained expanded and there has been no evidence of the recurrence of the empyema. In this instance it appeared that the most significant benefit from tryptic debridement occurred during the first few days of treatment.

Case 2. J. G., a 34 year old white male, was admitted to the Southwest Florida Tuberculosis Hospital on November 3, 1951, for his fifth period of sanatorium care. Pulmonary tuberculosis was first diagnosed in May, 1945. Therapeutic left pneumothorax was instituted in August, 1948, and continued until July, 1950, at which time it was abandoned due to fluid accumulation and spread of disease to the right lung. Fluid was aspirated from the left chest with fairly good re-expansion of the lung. Right pneumothorax was thereupon initiated and continued for nine months at which time it became necessary to discontinue because of occurrence of spontaneous pneumothorax following a refill.

At the time of the present admission, the right lung had completely re-expanded but there was noted a 50 per cent collapse of the left lung and the presence of a fluid



FIGURE 3—Case 1: Tuberculous empyema, left. Final result following enzymatic debridement with tryptar.

level. Grossly purulent fluid (800 cc.) was removed on January 21, 1952, and a number 16 French catheter was inserted into the left pleural cavity, sixth intercostal space, posterior axillary line, and connected to the negative pressure suction apparatus. The fluid was positive on culture for acid-fast organisms. Tryptar, 250,000 units, was introduced through the chest tube on four occasions, January 21, 22, 24 and 26, and left in the pleural space for a period of eight to 12 hours on each occasion, the chest tube being clamped off during this period. The empyema fluid became progressively thinner and tended to lose its grossly purulent character. Re-expansion of the lung occurred and the chest tube was removed. The lung has remained expanded in this case with no evidence of recurrence of fluid formation.

Although the left pneumothorax and pleural effusion in this case were of several



FIGURE 4—Case 2: Tuberculous empyema, left. Roentgenogram prior to treatment with tryptar.

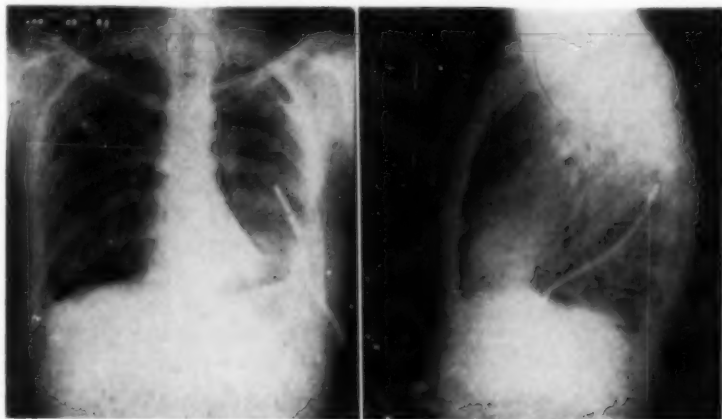


FIGURE 5—Case 2: Tuberculous empyema, left. Roentgenogram following fourth instillation of tryptar. Intercostal tube in place.

year's duration, the empyema was probably of rather recent origin. This case represents what appears to be a rather rapid cure of a tuberculous empyema.

Case 3. E. P., a 34 year old white female, had her apparent onset of tuberculosis in July, 1951. She was hospitalized at the Southwest Florida Tuberculosis Hospital on September 18, 1951, when sputum was positive for acid-fast bacilli. A course of streptomycin and para-aminosalicylic acid was given. On February 19, 1952, the apical-posterior segment of the left upper lobe was removed. The operation was uneventful, but failure of complete re-expansion occurred postoperatively and a residual apical space persisted. On March 10, 1952, 21 days postoperatively, an intercostal tube was placed in the first anterior interspace, left, and connected to the continuous negative suction apparatus. The lung still failed to re-expand completely and the tube was removed on March 18, 1952. On March 28, 1952, chest aspiration yielded purulent fluid. Culture of the fluid produced staphylococcus and gram negative bacilli, probably proteus. These organisms were resistant in vitro to penicillin, bacitracin, streptomycin, chloromycetin, aureomycin and terramycin. No acid-fast bacilli were cultured.

At the time of this aspiration, tryptar, 250,000 units, was placed within the empyema space. This was repeated daily for four consecutive days with progressive clearing and decrease in viscosity of the fluid. After a lapse of one week, a small amount of residual fluid and air space persisted and the same dosage was again administered on two occasions three days apart.

The patient has remained well and, although an apical cap persists on x-ray inspection, fluid can no longer be obtained on aspiration. She has subsequently been discharged as arrested.

Case 4. V. W., a 38 year old white female, had been treated intermittently since 1941 for pulmonary tuberculosis. Left therapeutic pneumothorax was instituted in 1942 and continued until the present time. In January, 1951, left pleural effusion developed and was treated by means of periodic aspiration. She was admitted to the Southwest Florida Tuberculosis Hospital in January, 1952, by which time the pleural effusion had become purulent. Culture was positive for *Staphylococcus aureus*, but negative for tubercle bacilli.

An intercostal tube was inserted in the first interspace anteriorly and connected to the suction apparatus. Two courses of tryptar were administered consisting of one



FIGURE 6—Case 2: Tuberculous empyema, left. Roentgenogram one month following completion of treatment with tryptar. Pleural space obliterated.

million units each. For the first course, 250,000 units per injection were given on March 13, 14, 16 and 18. The tryptar was left in the chest with the tube closed for periods ranging from eight to 12 hours when the chest tube was again connected to the negative pressure suction machine in an effort to remove the fluid and debris and re-expand the lung. The fluid became somewhat less viscid in character, but still remained grossly purulent. After the third injection, the fluid was blood-tinged. Re-expansion of the lung did not occur. The second course of tryptar consisted of 250,000 units, given on April 20, 21, 22 and 23. The lung did not re-expand. No growth of organisms was obtained, however, following the first course of tryptar. In retrospect, one could probably not hope for re-expansion in this case, the condition having been in existence for a period considerably in excess of the six month limit defined by Roettig, Reiser, Habeeb and Mark.

Severe headache, malaise and temperature elevation to 100 to 101° F. followed each instillation of the tryptar in this case, the reaction eventually being controlled by the administration of benadryl prior to the tryptar and subsequently as required.

Surgical decortication was eventually required in this patient and was performed on September 2, 1952. It is felt that tryptar materially added to the safety of decortication by its sterilizing action on the pleural fluid. A third series of eight injections of tryptar (250,000 units each) was administered just prior to surgery.

Case 5. F. W., a 37 year old white female, was known to have had tuberculosis since 1949. Following a year of sanatorium care during 1950-1951 and treatment with streptomycin and pneumoperitoneum, she was discharged. In October, 1951, left spontaneous pneumothorax occurred which rapidly progressed to hydropneumothorax and empyema. On admission to the Southwest Florida Tuberculosis Hospital on December 5, 1951, the left chest fluid was grossly purulent and positive on culture for acid-fast bacilli, *B. pyocyaneus* and hemolytic *Staphylococcus albus*. X-ray film at that time suggested a destroyed left lung with associated empyema. Because of the fluid, however, lung detail could not be seen satisfactorily. Despite the probable extensive, underlying pulmonary pathology, it was decided to attempt a trial of enzymatic debridement with tryptar. Accordingly, eight instillations of 250,000 units each (total 2,000,000 units) were administered on successive days following the insertion of an intercostal tube in the left third intercostal space, anterior axillary line. Tryptar was left in the space for eight to 12 hours on each occasion after which suction was applied to the chest tube.

No notable re-expansion of the lung occurred in this case, and none could be expected in view of the underlying pulmonary disease. Temporary decrease in the viscosity of the fluid was noted and no growth of organisms was obtained following completion of the series of treatments with tryptar.

Obliteration of the pleural space readily occurred following open drainage and she has subsequently been rehabilitated by Schede thoracoplasty. It is felt that instillation of tryptar contributed materially to the good result obtained.

Case 6. G. S., a 26 year old white male, was seen in consultation on May 19, 1952, with a history of insidious onset of bilateral pleural effusion, pericardial effusion, dyspnea and chest pain. It had become necessary to aspirate each pleural space at



FIGURE 7

FIGURE 8

Figure 7—Case 3: Non-tuberculous empyema following segmental resection for tuberculosis. Roentgenogram prior to treatment with tryptar. *Figure 8—Case 3:* Non-tuberculous empyema following segmental resection for tuberculosis. Roentgenogram following enzymatic debridement with tryptar.

ternately every two or three days at which time a liter or more of clear, straw-colored fluid was withdrawn with temporary relief of dyspnea. This procedure had been carried out for a period of about three weeks with no evidence of decrease in the amount of fluid formation. The fluid was negative on all examinations for malignant cells, acid-fast and other organisms, and fungi. No growth of organisms was obtained at any time. Physical examination, except for the chest, and other laboratory tests, including agglutinations, were all within normal limits. Biopsy of an enlarged cervical lymph gland was also negative.

Despite the puzzling nature of this case and our inability to diagnose the underlying cause of the polyserositis, it was felt mandatory to in some way combat the excessive pleural effusion and associated protein loss and discomfort to the patient. Accordingly, a number 16 French catheter was inserted first into the left pleural cavity through the ninth intercostal space, mid-axillary line and connected to the continuous suction apparatus. The tube was left in place for four days. Fibrin balls and sediment plugged the tube. It was decided to instill tryptar with two objectives in mind, to proteolyze the sediment allowing better drainage of fluid and perhaps irritate the pleural surfaces sufficiently to cause symphysis, thus arresting the formation of pleural fluid. This result was realized. Following removal of the chest tube, the pleural pocket was no longer noted and aspiration of a small amount of fluid from the left chest was required on only one subsequent occasion.

It was decided to carry out a similar procedure on the right side and this was accomplished with similar good results, although somewhat more time was required than on the left side.

Just how much credit can be given to tryptar in this case is difficult to evaluate. The same result might have been obtained by intercostal drainage alone. Tryptar, 250,000 units, was instilled only once on each side. Following this, on each occasion, he experienced malaise, rather severe chest pain on the side of the injection and moderate elevation of temperature. The pleural fluid became pink, indicative of tryptic action on the raw pleural surface.

Case 7. E. T., a 32 year old white female, developed pulmonary tuberculosis in July, 1945. Since that time, most of her life had been devoted to the treatment of this condition in and out of various sanatoria. Treatments included bilateral pneumothorax, antibiotic therapy, left thoracoplasty (1947), and right extrapleural pneumothorax (1948). She did well until March, 1952, at which time she developed fluid in the right extrapleural space which soon became purulent. This was treated by open drainage in April, 1952, and a tube has remained in place until the present time. Admission to W. T. Edwards Tuberculosis Hospital, Tallahassee, Florida, was on June 24, 1952.

On August 15, 1952, a course of tryptar was given consisting of 10 daily injections of 250,000 units into the right extrapleural space. A marked decrease in the viscosity and purulent character of the drainage was noted, but complete lung re-expansion did not occur. The drainage material was blood-tinged on several occasions. Some difficulty was experienced in retaining the tryptar because of the open drainage. Plugging the drainage tract with gauze was attempted.

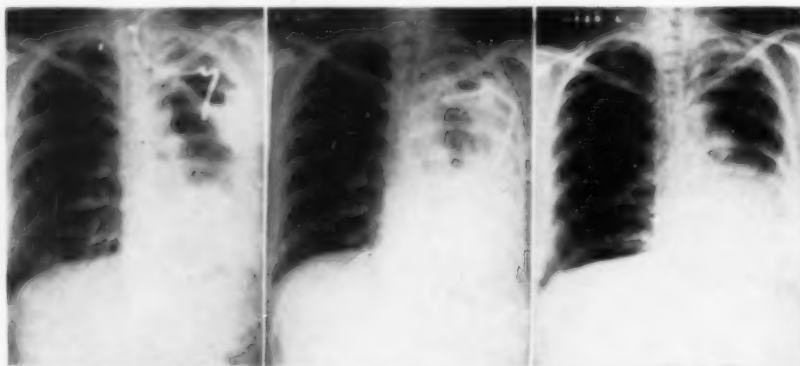


FIGURE 9

FIGURE 10

FIGURE 11

Figure 9—Case 4: Post-pneumothorax empyema with intercostal tube in place preparatory to treatment with tryptar. *Figure 10—Case 4:* Post-pneumothorax empyema. Failure of re-expansion following use of tryptar but sterilization of the space prior to surgical decortication. *Figure 11—Case 4:* Post-pneumothorax empyema. Roentgenogram subsequent to uncomplicated surgical decortication.

Although there was improvement in general well-being and a decrease in toxicity in this patient, as well as improvement in the character of the empyema fluid, results can not be classified as successful. The fact that the upper part of the lung had been compressed for four years with associated fibrosis and contraction would naturally mitigate against the possibility of re-expansion by tryptar in this case. Improvement, therefore, can only be measured in terms of decreased viscosity and sterilization of the fluid.

Case 8. A. H., a 43 year old colored male, underwent right upper lobectomy for a post-pneumonia chronic lung abscess at Tampa Negro Hospital on August 6, 1952. The surgical procedure and immediate convalescence were uneventful. On the 12th postoperative day the presence of bronchopleural fistula was suspected and within 48 hours a definite diagnosis of empyema was established. He was coughing up thick dark material characteristic of bronchopleural fistula and the chest x-ray film revealed a large right upper empyema space with a fluid level. Thick brown pus was aspirated from the post-resection space, this fluid being negative for growth of organisms on culture, probably as a result of intensive pre- and postoperative antibiotic therapy.

Despite the presence of an obvious bronchopleural fistula, it was decided to treat with tryptar through closed intercostal drainage. A number 16 French catheter was inserted into the empyema space in the anterior right first interspace, mid-clavicular line, and connected to the continuous negative pressure suction apparatus. 250,000 units of tryptar were instilled through the tube daily which was then clamped off for a period of eight to 12 hours to allow for maximum effect of the enzyme. Prior to injection of tryptar, the space was irrigated with saline on each occasion until returned clear. Tryptar instillation was performed for eight consecutive days with progressive thinning and decrease in the viscosity of the fluid as well as re-expansion of the remaining middle and lower lobes with obliteration of the space. Organisms were not cultured at any time.

This case must be classed as non-tuberculous empyema inasmuch as the tubercle bacillus was never demonstrated during his pulmonary ailment prior to surgery or subsequently. The rapid cure of postoperative empyema which may be expected following the use of tryptar is well demonstrated by this case. The presence of a bronchopleural fistula did not appear to contraindicate its use and this readily closed during the course of tryptar therapy.

SUMMARY AND CONCLUSIONS

The cases presented illustrate some of the situations in which the pancreatic enzyme trypsin can be used for the purpose of selective intra-



FIGURE 12



FIGURE 13

Figure 12—Case 8: Lung abscess, right upper lobe. Preoperative roentgenogram. *Figure 13—Case 8:* Lung abscess. Roentgenogram subsequent to right upper lobectomy complicated by broncho-pleural fistula and empyema. Intercostal tube in place for closed drainage and instillation of tryptar.

pleural proteolytic debridement. These included tuberculous empyema, tuberculous infection of the extrapleural space, mixed tuberculous empyema, non-tuberculous empyema following resection for tuberculosis, non-tuberculous postoperative empyema, and non-specific bilateral pleural effusion of an indeterminant nature.

Complete cure was obtained in the two cases of tuberculous empyema and the two cases of postoperative empyema, and almost complete relief obtained in the case of bilateral effusion of unknown origin. Improvement as manifested by decrease in viscosity and sterilization of the fluid was noted in the other three cases and contributed to eventual good surgical results in this manner. Following these initial encouraging experiences, tryptic debridement has subsequently been employed in an additional 22 patients with comparable results. In addition to the above mentioned indications, this method has been successfully used in the treatment of postoperative and traumatic hemothorax.

It is concluded that tryptic debridement is a valuable adjunct in the treatment of intrapleural infections and hemothorax and is deserving of more widespread usage. Side effects are few and inconsequential. Its use is not necessarily contraindicated in the presence of bronchopleural fistula.

RESUMEN

Los casos que se presentan ejemplifican algunas de las condiciones en que la enzima tripsina pancreática, puede usarse para obtener la desbridación proteolítica intrapleural selectiva. Tales condiciones incluyen el empiema tuberculoso, la infección tuberculosa del espacio extrapleural,



FIGURE 14—Case 8: Lung abscess. Final roentgenogram following removal of tube and re-expansion of lung with healing of broncho-pleural fistula and obliteration of the empyema space.

el empiema mixto tuberculoso, el empiema no tuberculoso después de resección por tuberculosis, el empiema postoperatorio no tuberculoso y el derrame pleural bilateral no específico, de naturaleza indeterminada.

Se obtuvo una cura completa en dos casos de empiema tuberculoso y en dos casos de empiemapostoperatorio, un alivio casi completo se obtuvo en el caso de derrame pleural bilateral de naturaleza desconocida. Se notó la mejoría por el decrecimiento de la viscosidad y la esterilización del líquido se notó en los otros tres casos y contribuyó a los buenos resultados quirúrgico logrados.

Después de estos alentadores iniciales la desbridación triptica se empleó en otros 22 enfermos con resultados comparables. Además, de las indicaciones ya mencionadas este método se ha empleado con éxito en el tratamiento del hemotórax postoperatorio y traumático.

Se concluye que la desbridación triptica es un agregado valioso en las infecciones intrapleurales y en el hemotórax y que merece un uso más extenso. Los efectos colaterales son pocos y sin consecuencias. Su uso no está necesariamente contraindicado en presencia de fístula bronco-pleural.

RESUME

L'auteur présente certains cas où la trypsine peut être utilisée pour provoquer une action protéolytique. Ces cas comprenaient: une pleurésie purulente tuberculeuse; une infection tuberculeuse de cavité extra-pleurale; une pleurésie purulente tuberculeuse avec germes associés; une complication pleurale infectieuse et non tuberculeuse survenue à la suite d'exérèse pour tuberculose; une pleurésie purulente post-opératoire non tuberculeuse; et un épanchement pleural bilatéral de nature indéterminée. Une guérison complète fut obtenue dans les deux cas de pleurésies purulentes tuberculeuses et dans les deux cas de pleurésie purulente post-opératoire, et une guérison presque complète dans le cas d'épanchement bilatéral d'origine indéterminée. Dans les trois autres cas, on put noter une amélioration caractérisée par la diminution de la viscosité du liquide, et sa stérilisation, ce qui contribua à de bons résultats chirurgicaux ultérieurs.

A la suite de cet essai encourageant, la trypsine fut utilisée successivement chez 22 autres malades, avec des résultats comparables. En outre des indications qui viennent d'être mentionnées, la méthode a été utilisée avec succès pour traiter des hémithorax post-opératoires ou traumatiques.

L'auteur conclut que l'action protéolytique de la trypsine est un auxiliaire de valeur dans le traitement des infections intrapleurales et des hémithorax, et que son usage devrait être plus étendu. Les complications de ce traitement sont minimales, et pratiquement négligeables. L'existence d'une fistule broncho-pleurale n'est pas une contre-indication formelle.

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Topical Hydrocortisone in Pleuropericardial Exudations

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The anti-inflammatory and antiexudative properties of hydrocortisone, both systemic and topical, have been well established by numerous investigators. Similarly, it has been established that pharmacologically local hydrocortisone is far more active than cortisone.

On the basis of a report by Hollander et al.¹ of remarkable improvement with the use of hydrocortisone acetate in a case of pleural effusion complicating lupus erythematosus, we were induced to try the hormone locally in serositis complicating rheumatic fever. Favorable results were obtained, which were published in preliminary reports.^{2, 3} A fuller report was submitted to the International Congress of Rheumatic Diseases in Geneva, in 1953.⁴

Case Material

Seven patients with unilateral or bilateral pleurisy and three with pleuropericarditis have been treated to date. All of the pleural complications were exudative, and for the most part of rheumatic origin. Seven of the 10 had previously been treated with cortisone acetate by intramuscular injection. The latter produced the usual general improvement but could not completely suppress the serosal effusion. Phenylbutazone in one had produced only partial improvement. Another had been treated for a few days with streptomycin and isoniazid, without success; the primary exudate had localized in both the pleurae and the pericardium. The 10th had pleural effusion following therapeutic pneumothorax for a circumscribed cavernous tuberculous lesion.

Technic

Following partial drainage of the cavity, where necessary, from 75 to 100 mg. of hydrocortisone acetate was introduced. Usually only one injection of hydrocortisone was given; in some cases, in which initial results were only partially successful, the injection was repeated once, and in rare instances twice, at six to eight-day intervals.

Laboratory Studies

In addition to the clinical observations, the morphologic pattern of the cellular elements, as well as the relative viscosity⁵ and mucoprotein content of the exudate⁶ were studied. In addition, the following factors in the serum, in which the authors were particularly interested were studied: total polysaccharides,⁷ mucoproteins⁸ and sedimentation rate (Westergren method).

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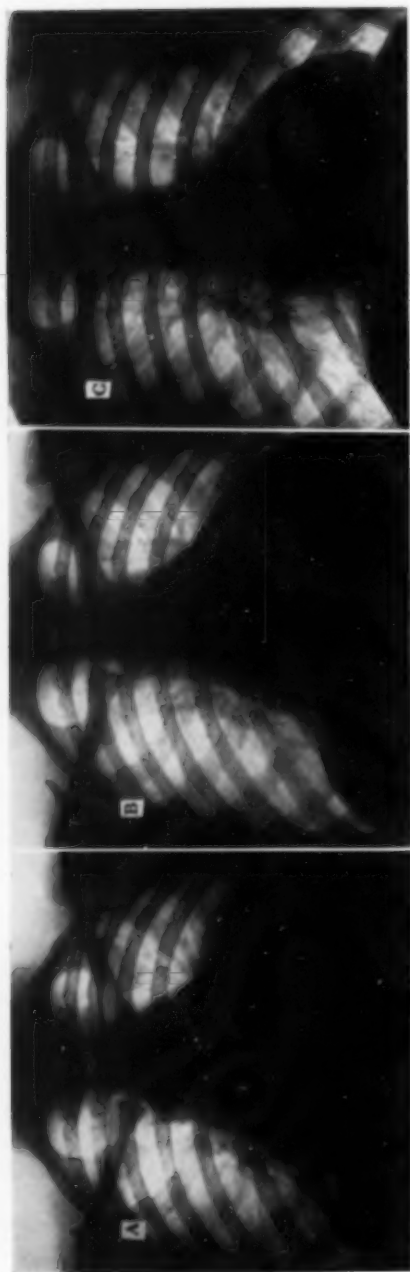


FIGURE 1: (Case No. 3) Effect of local hydrocortisone acetate on pleural and pericardial effusion: (A) Roentgenogram showing pleural and pericardial effusion before treatment; (B) 8 days after the introduction of 100 mg of hydrocortisone into the left pleural cavity; (C) 9 days after a second introduction of 75 mg. of hydrocortisone; complete recovery.



FIGURE 2: (Case No. 8) Effect of local hydrocortisone acetate on pleural and pericardial effusion: (A) Roentgenogram showing pleural and pericardial effusion before treatment. (B) 21 days after the introduction of 75 mg into the pericardial cavity and ten days after the introduction of 50 mg of hydrocortisone into the left pleural cavity. (C) 13 days after a third introduction of 100 mg of hydrocortisone into the left pleural cavity: complete recovery.

rheumatic fever, even in cases in which systemic cortisone or hydrocortisone is unsuccessful. Two cases of possible tuberculous origin have some features in common with cases recently reported by Linquette et al.,⁸ who successfully treated tuberculous serositis with intramuscular cortisone and intrapleural instillation of hydrocortisone.

The use of hydrocortisone acetate as described in the present paper, minimizes the possible systemic effect⁹ and reduces the likelihood of exacerbating the infectious process. Contraindications to pleural or pericardial instillation seem to be rare; even primary tuberculous lesions are not necessarily contraindications.

The precise way in which hydrocortisone affects the pleural effusion is not well understood. It has been suggested^{10, 11, 12} that it may be a topical anti-inflammatory effect, and our results seem to confirm this.

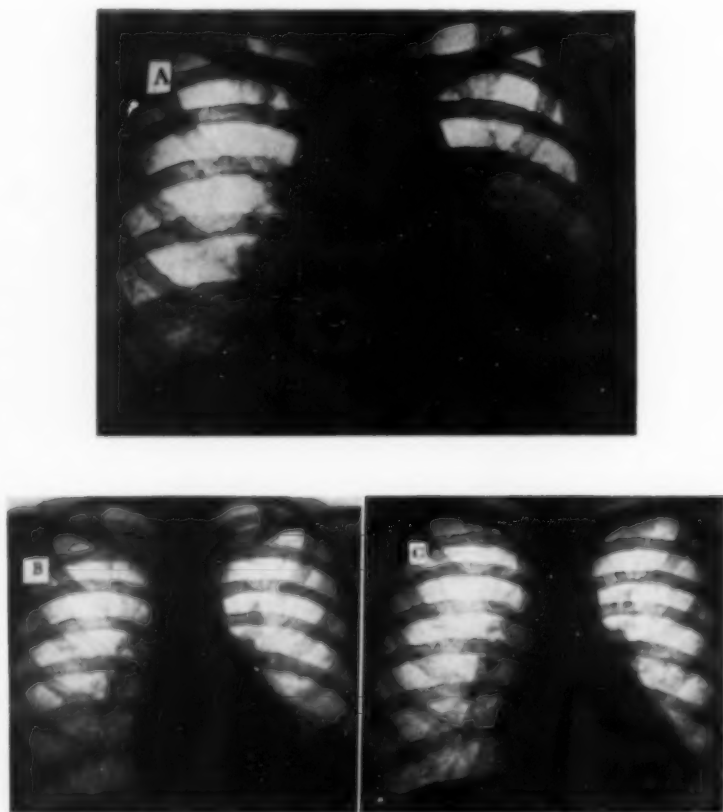


FIGURE 3: (Case No. 9) Effect of local hydrocortisone acetate on pericardial and pleural effusions: (A) Roentgenogram before treatment. (B) 5 days after the introduction of 75 mg of hydrocortisone into the pericardial cavity. (C) 8 days after a second introduction of 100 mg of hydrocortisone into the left pleural cavity: complete recovery.

SUMMARY

Favorable results are reported with hydrocortisone acetate locally in 10 patients with pleural or pericardial changes accompanying rheumatic fever. These are ascribed to the anti-inflammatory properties of the drug. Contraindications to such therapy are rare.

RESUMEN

Se refieren resultados favorables del empleo del acetato de dihidrocortisona localmente en 10 enfermos con alteraciones pleurales o pericárdicas que acompañaban a la fiebre reumática. Se atribuyen esos resultados a las propiedades anti-inflamatorias de la droga. Son raras las contraindicaciones de tal tratamiento.

RESUME

Les auteurs rapportent des résultats favorables obtenus grâce à l'injection locale d'acétate d'hydrocortisone chez dix malades atteints de localisations pleurales ou péricardiques, au cours d'un rhumatisme articulaire aigu. Ces constatations s'expliquent par les propriétés anti-inflammatoires de ce produit. Ce traitement n'a que de rares contraindications.

ADDENDUM

Since this manuscript was prepared, we have treated 23 more cases of exudative effusions of different etiology in collaboration with Dr. F. Grassi of Vialba Sanatorium, with the following results: 1) topical hydrocortisone acetate may be used favorably in tuberculous pleurisy or in effusions of extrapleural pneumothorax; in these cases the use of antitubercular drugs and the valuation of lung lesions are mandatory. 2) forms of bacterial etiology may also be favorably treated, in association with antibiotics.

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Heteroplastic Ossification in Chronic Lung Abscess*

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Heteroplastic ossification is a condition characterized by the formation of true bone in soft tissues. The appearance of lamellae, canaliculi, and lacunae is prerequisite; bone marrow may be found. It is believed that pathologic calcification is a necessary precursor for ossification. A review of the entire subject is, therefore, warranted.

Pathologic calcification is usually found in diseased tissue; it is generally referred to as "dystrophic," as opposed to the "metastatic" type which accompanies metabolic disturbances, and which rarely undergoes ossification. Dystrophic calcification occurs most commonly in hyalinized fibrous tissues associated with chronic inflammation, such as in tuberculous scars, pericarditis and mitral stenosis.

While the exact mechanism of dystrophic calcification is not fully understood, certain factors relating to it have been established: there is an increased alkalinity of the tissues, a local increase of phosphatase and inorganic phosphates and antecedent fatty degeneration or necrosis.¹ Apparently local tissue injury and alkalization are both necessary; whether or not a toxic factor operates has not been established.² Meeker has demonstrated that the chemical composition of these calcified masses is the same as that of normal bone.³

Once dystrophic calcification has occurred, continuation of the process with resultant ossification is always possible. Karsner believes that the mechanism consists basically of the following sequence of events: calcification follows inflammation; granulation tissue then erodes this calcareous mass and new connective tissue cells from the granulation tissue undergo functional metaplasia and act as osteoblasts. Moore goes a step further, stating that the osteoblasts subsequently form trabecular bone, and between the trabeculae and spicules there is fibrous tissue or typical bone marrow.⁴ Other than the presence of calcium salts, the exact stimulus to this metaplasia is not known. In many old deposits of calcium there may be gradual conversion to bone. It is probably similar to endochondral bone formation, with calcified masses taking the place of cartilage. Obviously, an adequate blood supply will favor ossification. Wells states that, "in order to have ossification of calcific deposits, certain conditions of relationship between calcium salts, fibrous tissues and blood supply evidently must be exactly met."⁵ Herbut points out the "vicious cycle" aspect of heteroplastic ossification: the presence of bone in an abscess prolongs the infection which in turn favors bone formation.⁶

Grossly, ossification in soft tissues can not be differentiated from calcification. Microscopically, the elements of bone are irregularly arranged.

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When marrow is present it is usually fatty; chronic inflammation surrounds the bone. Cartilage has not been observed in man.²

Ossification in chronic pulmonary lesions is said to be fairly common, especially in bronchial cartilages and in tuberculous scars. Wells and Dunlap⁷ collected 53 cases of diffuse ossification of lungs unassociated with tuberculous scars occurring in aged men and young individuals with mitral stenosis. Characteristically, small flakes of bone were found throughout the lungs.

Despite the fact that the textbooks state that ossification can occur in chronic pulmonary infections, there is a paucity of such cases in the literature. No report can be found in which *true* bone formation occurred in a lung abscess. We present such a case.

Case Report

A 35 year old white female was admitted to the Southern Division of the Albert Einstein Medical Center in January, 1951, with the history of chronic cough accompanied by copious expectoration of muco-purulent material. About one year previously she had been hospitalized because of fulminating Friedländer's pneumonia. The present complaints had persisted since recovery from the acute episode. X-ray films showed cavitation in the left upper lobe (*Figs. 1 & 2*). Frequent bronchoscopies consistently revealed purulent discharge from the left upper lobe bronchus. Cultures had shown a mixed infection. Antibiotics offered no improvement. Consequently, left upper lobectomy was performed. Dense adhesions necessitated extrapleural dissection. Palpation of the abscess wall elicited a denseness that suggested calcification. In fact, there were extensions of calcified material from the left upper lobe to the anterior mediastinum and posterior chest wall.

Examination of the specimen revealed a large abscess cavity measuring 8 x 6 x 4 cms. A large portion of the wall was calcified, the remainder was composed of thick fibrous tissue. The main stem bronchus led into the cavity (*Fig. 3*). Microscopic sections of abscess wall revealed fibrous tissue in which there appeared new alveolar formations and marked chronic inflammatory cell infiltration. Portions of bronchus were markedly dilated and contained areas of bone and bone marrow metaplasia. The surrounding lung parenchyma gave evidence of severe chronic bronchitis, bronchiolitis and associated bronchiectasis (*Fig. 4*).

The immediate post-operative course was satisfactory. She is now enjoying good health, four years following surgery.

Discussion

In this case, a chronic lung abscess developed following recovery from acute Friedländer's pneumonia. Fortunately, only about 1 per cent of all bacterial pneumonias are caused by Friedländer bacilli. Prior to the antibiotic era, the mortality from such infections was 50-80 per cent.⁸ Today, however, most persons with these acute pneumonias recover; we shall therefore, no doubt, see a higher incidence of chronic pulmonary disease secondary to Friedländer infections. One may further speculate that there will appear more instances of heteroplastic ossification, since apparently all the factors favoring this phenomenon will be present: tissue necrosis, chronic inflammation with fibrosis and a rich blood supply.

SUMMARY

A case is reported of chronic lung abscess due to Friedländer infection in which there occurred heteroplastic ossification.

The presence of *true* bone was accompanied by actual *bone marrow* formation.

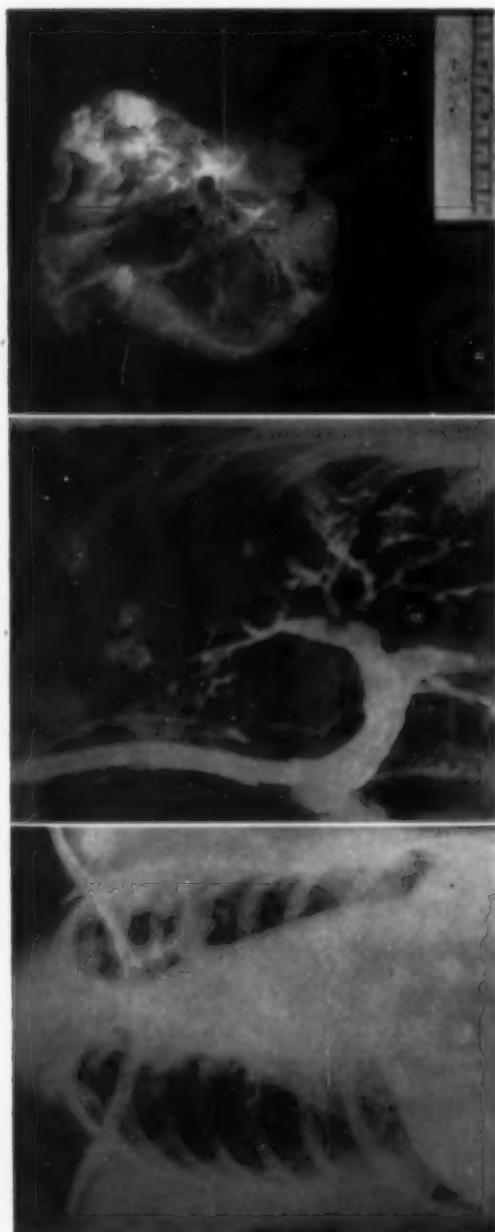


FIGURE 1

Figure 1: X-ray film of Chest. Cavity in left upper lobe. Bronchus leads into cavity in left upper lobe. Calcification is demonstrated in the wall of the cavity.

FIGURE 2

FIGURE 3

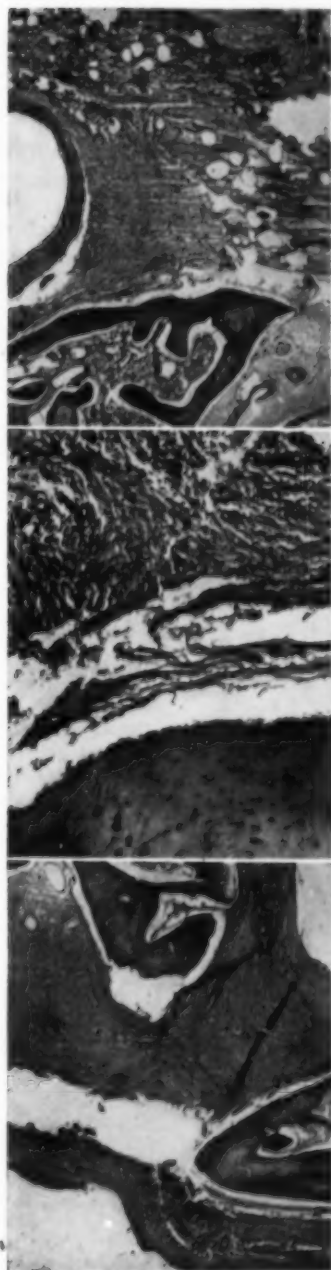


FIGURE 4A

FIGURE 4B

FIGURE 4C

Photomicrographs. *Figure 4A—20X.* Low power cancellous lamellar bone with surrounding inflammatory fibrous reaction in lung tissue. *Figure 4B—100X.* High power of A. *Figure 4C—20X.* Low power. Bone with marrow elements evidencing true ossification.

As far as can be determined this is the first such case reported in the literature of solitary pathologic ossification in a chronic lung abscess.

The mechanism of pathologic calcification and ossification is reviewed.

RESUMEN

Se relata un caso de absceso pulmonar crónico, debido a infección por bacilo de Friedlaender en el que ocurrió osificación heteroplástica.

La presencia de *verdadero hueso* se acompañó por formación de *médula ósea*.

Hasta donde puede saberse, este es el primer caso referido de esta índole de osificación solitaria patológica en un absceso pulmonar crónico.

Se revisa el mecanismo de la calcificación patológica.

RESUME

Les auteurs rapportent une observation d'abcès chronique du poumon à bacilles de Friedlander, dans laquelle se constituait une ossification hétéroplastique.

La présence d'os véritable s'accompagnait de formation de moelle osseuse en activité.

Les auteurs pensent qu'il s'agit du premier cas rapporté dans la littérature, ayant donné lieu à une telle ossification isolée, pathologique, au cours d'un abcès chronique du poumon. Les auteurs passent en revue le mécanisme des calcifications et des ossifications pathologiques.

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Contra-Lateral Spontaneous Pneumothorax as a Complication of Intrathoracic Operations*

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There is a definite trend of reduced mortality and morbidity following thoracic surgical procedures. This is due largely to prevention as well as recognition and prompt treatment of postoperative complications. One of the unusual complications which does occur from time to time is contra-lateral spontaneous pneumothorax. Such a complication following collapse therapy for pulmonary tuberculosis has been repeatedly observed,¹ however, this occurrence following intrathoracic operations is apparently rare. The exact incidence is difficult to determine since it is doubtful if all recognized cases have been reported and, also, it is possible that not all such complication has been recognized. The latter possibility is quite great in view of the nature of spontaneous pneumothorax, since, at post mortem, the pathologist may be misled in his conclusions without an antemortem suspected diagnosis.

So far, there have been eight cases of this type reported in the literature, Stephen's² three cases reported in 1936 being the earliest available description of such an incidence. More recent references in the literature are case reports of Gleason and Kent³ in 1949 (one case), Melick and Gutekunst⁴ in 1950 (one case), Beno and Weisel⁵ in 1952 (three cases). Out of these eight cases so far reported, five survived and three died as the direct result of this complication. Death in each instance was apparently due to delay in recognition and treatment. This report is being made in order to re-emphasize the potential danger and outline the treatment which, if promptly instituted, can alter the course of this otherwise fatal complication.

Report of Cases

Case 1: J. G., East Orange General Hospital No. 83120, a 13-year-old white male was admitted on November 4, 1950, with symptoms of shortness of breath and cyanosis of 24 hours duration. Diagnosis at the time of admission was spontaneous left pneumothorax.

Family history and personal history were negative except for measles at the age of five and virus pneumonia when seven years old.

History of the present illness dated to about three months prior to this admission when he had a similar episode of spontaneous pneumothorax on the left side which subsided after a few days of bed rest. Two months later, another attack occurred on the left side and again responded to a few days of bed rest.

Physical examination was negative except for a moderate amount of cyanosis and presence of pneumothorax on the left side. Chest roentgenogram (Fig. 1) revealed 75 per cent collapse of the left lung. Over the apex of the left upper lobe, a large cystic area could be outlined. The right lung seemed to be normal.

Laboratory studies were within normal limits. He was treated initially with bed rest and removal of 3 liters of air from the pleural cavity.

Since this was the third episode of spontaneous pneumothorax within a relatively short time, and the chest roentgenograms showed the presence of a cystic area over the apex of the left upper lobe, resection of the cyst was decided upon and carried out on the seventh day after admission.

*Winner of second prize in the 1953 College Essay Award.

From the Surgical Service of the East Orange General Hospital and the Mountain-side Hospital, Montclair, New Jersey.

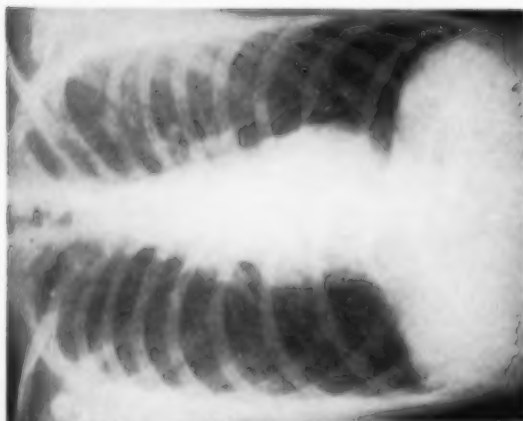


FIGURE 3

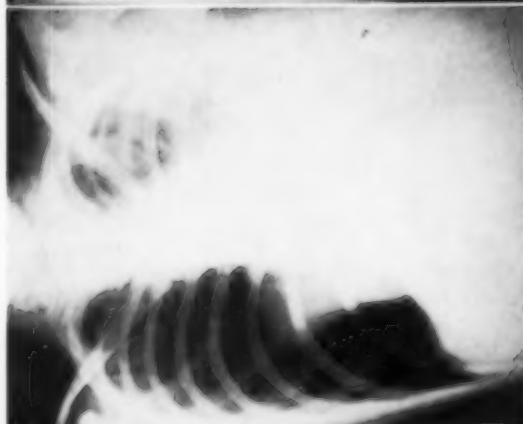


FIGURE 2



FIGURE 1

Through a postero-lateral incision, the pleural cavity was entered and a giant cyst of the left upper lobe was found, with three small satellite cysts. The large cyst was held out by fine adhesions from the posterior aspect of the pleural cavity; the site of rupture could not be seen even after submersion of the lung in saline solution. The cyst was resected and the stump closed by a continuous suture. The lung was re-expanded and the chest closed. Pathological examination of the specimen revealed it to be a cyst with alveolar cell type of epithelial lining.

Postoperative condition of the patient was extremely smooth. In fact, he was ambulatory on the second postoperative day. On the third postoperative day, while getting up from the bed, he experienced a sudden sharp pain over the right side of the chest and became extremely cyanotic. Physical examination revealed the presence of pneumothorax on the right side. Immediately, a needle was inserted in the right pleural cavity (contra-lateral to the operative side) and high positive pressure reading obtained. Four thousand cubic centimeters of air were removed. The patient's condition improved enough to allow a chest x-ray film (Fig. 2). This revealed 90 per cent collapse of the right lung and an area over the apex of the right upper lobe suggestive of a cyst. Conservative therapy by means of repeated needle aspirations led to only a temporary relief of dyspnea. It was obvious that something other than repeated chest aspirations would be necessary in order to overcome the recurring tension-pneumothorax. Eight hours after the onset of the contra-lateral spontaneous pneumothorax, under local anesthesia, a thoracoscope was introduced through the fifth interspace and midaxillary line. Exploration revealed the presence of a collapsed lung; over the apex of the upper lobe, a giant cyst was seen held to the parietal pleura by multiple fine bands of adhesion. The area of the tear could not be visualized. A catheter (No. 12 French) was inserted in the pleural cavity and connected to a Stedman pump. The suction apparatus was arranged with a water trap and suction maintained at 15 centimeters of water. This was soon found to be inadequate because of continuous leakage of a large amount of air for eight days with no roentgenological sign of improvement in the state of the collapsed right lung. It was then assumed that probably the intrapleural adhesions prevented spontaneous closure of the ruptured area and that the air was leaking into the pleural space as fast as it was being removed. Consequently, right thoracotomy was preformed on the ninth day after the original operation on the left side. The right lung seemed to be completely collapsed. A giant cyst was found over the right upper lobe, quite identical to the one removed from the left side. There were several fine adhesions between the cyst and the chest wall. The site of rupture was 3.5 centimeters in length. The cyst was removed and the stump closed with interrupted suture and the lung expanded. His general condition following this second operation was satisfactory and the postoperative course uneventful. He was ambulatory on the second and discharged home on the ninth postoperative day.

The follow-up roentgenogram of the chest showed satisfactory re-expansion of both lungs (Fig. 3). Examination one-and-one-half years following bilateral thoracotomy revealed good physical condition. There has not been re-occurrence of spontaneous pneumothorax.

Case 2: S.M., Mountainside Hospital No. 95396, a 46-year-old Negro male was admitted on June 9, 1952, with chief complaint of shortness of breath on moderate exercise. History of present illness dated to about a year ago when he experienced an attack characterized by sharp pain in the right chest. He was then hospitalized at Morristown Memorial Hospital where a diagnosis of spontaneous pneumothorax was made. He was treated by bed rest and discharged after a few days to continue bed rest at home. While at rest, he experienced several similar attacks of dyspnea, however, he gradually improved and for the last three months felt well except for persistent respiratory embarrassment when walking or climbing stairs. About a month before this admission, a roentgenogram of the chest revealed pneumothorax still present, the lung 50 per cent collapsed and a fluid-containing cyst over the right upper lobe. He was then referred to The Mountainside Hospital for observation and treatment. Previous general health had been good. The family history was negative.

The initial physical examination disclosed a well-developed, well-nourished Negro in no acute distress. Temperature, pulse and respirations were normal. The chest showed good expansion on the left side but none on the right. Breath sounds were absent on the right side. No rales or rhonchi were heard on the left.

The initial laboratory findings were negative except for the presence of moderate hemoconcentration (Hematocrit 52 volume packed red blood cells per 100 cubic centimeters of blood); sputa and gastric washings were negative for tuberculous bacilli. Roentgenograms of the chest revealed the right lung about 50 per cent collapsed by pneumothorax with a large area of radiolucency over the apex, suspected to be a cyst (Fig. 4).

A needle was introduced in the pneumothorax space and a negative reading obtained (—14, —11). Bronchoscopic examination failed to reveal the presence of endobronchial pathology.



FIGURE 6

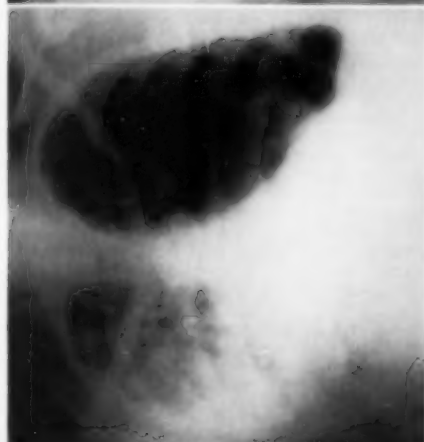


FIGURE 5



FIGURE 4

On June 16, 1952, thoracotomy was performed on the right side through a postero-lateral approach. Exploration of the right lung revealed the presence of a single large thin-walled emphysematous bulla of the right upper lobe. The lung was held down by a pleural membrane. Some pleural fluid was present. The cyst was opened widely and resected by keeping tension on the cyst wall. Thus, an accurate identification of the attachment of the base of the cyst to the lung was made and the stump closed with interrupted fine silk. Decortication of the lung was performed following the standard technique, drainage tubes inserted and the chest closed in routine manner.

Postoperative condition was satisfactory. Portable roentgenogram of the chest made the following morning revealed complete re-expansion of the lung on the operative side. However, at 8 A.M. of the same day (28 hours postoperative), he suddenly became dyspneic. Physical examination revealed the trachea to be deviated to the operative side. No breath sound could be heard over the left chest. Immediately, a needle was inserted in the pleural cavity and 2000 cubic centimeters of air removed. Following the above procedure, his condition improved enough to allow a bed side roentgenogram of the chest which substantiated the clinical impression of contra-lateral spontaneous pneumothorax (Fig. 5). Since the improvement was temporary, two hours later, under local anesthesia, a catheter was introduced through the third anterior interspace and midaxillary line into the left pleural cavity and connected to the underwater drainage bottle. Dramatic improvement occurred following the above procedure. About 24 hours later, his condition again deteriorated. Respirations became labored and pulse thready. Examination revealed the reason for this re-occurrence to be clogging of the drainage tube. This was corrected and his condition improved. On the fourth postoperative day, he experienced a sudden sharp pain over the left chest and within the space of one hour, a large amount of subcutaneous emphysema over the head and neck was noticed, while the drainage tube was apparently in good working condition. He became extremely cyanotic and blood pressure and pulse became unobtainable. Through an anterior-intercostal approach, the left chest was immediately opened and a large amount of air under pressure escaped from the pleural cavity. The heart was found at standstill, cardiac massage was instituted and after about two minutes, cardiac function was restored. The blood pressure came back to normal. Exploration of the left lung at this time revealed the presence of a giant cyst over the left upper lobe. The line of rupture measured about 5 centimeters in length. The latter was kept patent by several intrapleural adhesions. The cyst was excised and the stump closed with fine silk. Two large drainage tubes were inserted in the pleural cavity and the chest closed in routine manner.

After this episode, the postoperative course was entirely uneventful and he was discharged home on his 12th postoperative day.

Pathological diagnosis of the cyst removed from the right, as well as from the left upper lobe, was giant emphysematous bulla.

The follow-up roentgenogram of the chest showed satisfactory re-expansion of both lungs (Fig. 6). Examination six months following bilateral thoracotomy revealed no symptom and he was working full time as a laborer. There has not been re-occurrence of spontaneous pneumothorax.

Discussion

Several mechanisms have been proposed with regard to production of spontaneous contra-lateral pneumothorax. Stephens² stated that the etiologic factor in each of his three cases was a communication through the mediastinal wall, although the site of tear could not be visualized at necropsy. This view was also shared by Kneopp.⁶ However, in the case reported by Gleason and Kent, and three cases reported by Beno and Weisel, a ruptured emphysematous bleb was believed to be the main factor in the production of this complication. In the two cases presented here, a ruptured emphysematous bleb was found to be the only reason for the production of the spontaneous contra-lateral pneumothorax. In both cases, the site of rupture was well demonstrated at the time of exploration.

Symptoms and physical findings are those of a spontaneous pneumothorax; the degree of respiratory embarrassment however, seems to depend on the amount of tension present in the pneumothorax space as well as on the degree of fixation of the mediastinum. The case described by

Gleason and Kent in which left lower lobectomy for bronchiectasis had been performed, dyspnea and cyanosis were only moderate while in the two cases just described, where pulmonary pathology was not of inflammatory nature, the respiratory embarrassment was severe.

In analyzing the eight cases reported in the literature, it is striking that death in each instance was due to delay in recognition and institution of treatment of this condition. Treatment should be carried out on the basis of physical findings alone, if the condition of the patient does not allow time to lose to have roentgenograms of the chest. Emergency treatment is simple and effective. Decompression of the tension pneumothorax by immediate thoracentesis is all that is needed. Roentgenological examination and other diagnostic procedures should be done only after the severe subjective symptoms are relieved. Alexander⁷ stated, any diagnostic measure which is not capable of relieving the respiratory embarrassment is contra-indicated.

After the acute episode is overcome, intrapleural catheter drainage and continuous suction should be applied. Thoracotomy may become necessary in instances such as in the case of Gleason and Kent and the two cases here presented.

SUMMARY

1. Two cases of spontaneous contra-lateral pneumothorax following resection of pulmonary cyst are reported.
2. In both cases, ruptured contra-lateral emphysematous bleb was proved to be the etiologic factor.
3. The dangers of contra-lateral spontaneous pneumothorax following intrathoracic operations are that of tension pneumothorax, collapse of the lung opposite to the operative side and mediastinal shift. The severity of respiratory embarrassment resulting from the above depends on the degree of fixation of the mediastinum. If the latter is freely mobile, the respiratory embarrassment may quickly be followed by complete failure.
4. The diagnosis is made on the basis of physical findings of pneumothorax opposite the operative side in a patient presenting an acute respiratory distress.
5. Emergency treatment should be undertaken without delay since the time lost until chest roentgenogram is taken may precipitate irreversible respiratory failure. Treatment is simple and effective. The decompression of the tension pneumothorax by immediate thoracentesis is all that is needed. Roentgenological examination and other diagnostic procedures should be done only after the severe respiratory symptoms have been relieved.

RESUMEN

1. Se refieren dos casos de neumotórax espontáneo contralateral, después de la resección que ampollas pulmonares.
2. En ambos casos, se demostró que la causa fué la ruptura de ámpuas enfisematosas contralaterales.

3. Los peligros del neumotórax espontáneo contralateral, consisten en que puede ocurrir el neumotórax a tensión, colapso del pulmón opuesto al que se opera y desplazamiento del mediastino. La severidad del trastorno respiratorio que resulta de lo anterior, depende del grado de fijación del mediastino. Si éste es libremente móvil, el trastorno respiratorio puede ser sucedido de insuficiencia completa.

4. El diagnóstico se hace sobre los hallazgos físicos de neumotórax opuesto al lado que se opera en un enfermo que tiene grandes trastornos respiratorios.

5. El tratamiento es sencillo y eficaz. La descompresión del neumotórax a tensión, es todo lo que se requiere. El examen radiológico y otros procedimientos de diagnóstico deben intentarse solo cuando los síntomas severos se hayan aliviado.

RESUME

1) Les auteurs rapportent deux cas de pneumothorax spontané controlatéral faisant suite à la résection d'un kyste pulmonaire.

2) Dans les deux cas, on put démontrer que la rupture d'une bulle emphysémateuse controlatérale en avait été responsable.

3) Les dangers du pneumothorax spontané controlatéral faisant suite aux interventions intrathoraciques sont fonction de la pression intrapleurale du pneumothorax, de l'importance du collapsus du poumon et de la déviation médiastinale. La gravité de la gêne respiratoire qui en résulte dépend du degré de fixité du médiastin. Si celui-ci est complètement libre, la gêne respiratoire peut être suivie rapidement d'une insuffisance respiratoire complète.

4) Chez un malade présentant une gêne respiratoire aiguë, le diagnostic de pneumothorax du côté opposé au poumon opéré se base sur les constatations physiques.

5) Le traitement doit être entrepris d'urgence. Le temps que l'on perdrait à attendre les résultats de la radiographie pourrait amener au stade d'insuffisance respiratoire irréversible. Le traitement est simple et efficace. La suppression de l'hyperpression gazeuse intrapleurale par simple thoracentèse est suffisante. Ce n'est qu'après la disparition des signes graves d'insuffisance respiratoire qu'on pourra faire appel à l'examen radiologique et aux différents autres procédés de diagnostic.

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Unexpected Death in Asthma

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The prognosis in asthma, so far as duration of life is concerned, is generally considered to be good and it is a fact that the majority of asthmatic patients, although they may have to live a restricted life, learn to compensate for their disability and may even accomplish a great amount of useful work. In the usual course of events emphysema is likely to supervene, and death most commonly occurs from congestive heart failure or from respiratory infection. It is customary to console the asthmatic patient with the assurance that the duration of life is not likely to be affected, and this optimistic view is commonly justified in the event.

A study of the text books on general medicine shows that authors are almost unanimous in supporting the opinion that asthma by itself is not a lethal condition, and reassuring views are expressed on prognosis. Osler and McCrae (1921) quote the assertion of Oliver Wendell Holmes that asthma is "the slight ailment that promotes longevity." Monro (1924) considers that the prognosis is good, if the cause can be removed; the liability to asthma is not inconsistent with many years of fitness for work. Conybeare (1936) states that it is doubtful whether death has ever been caused by uncomplicated asthma.

Most authors of text books on disease of the respiratory tract are, however, more cautious. Davidson (1948) considers that the outlook in asthma is very uncertain, but that the actual attacks are "very seldom" fatal. Coope (1948) quotes the statement that no one ever dies from an asthmatic attack and comments that this is not entirely true, but he goes on to suggest that sudden death occurs as a result of established cardio-respiratory changes. Cecil and Loeb (1951) divide their asthmatic cases into two groups, "extrinsic" and "intrinsic." The extrinsic cases are those which occur in young people; the intrinsic group includes patients in whom the asthma begins after the age of 30, and the factors concerned are stated to be bacterial, allergy, depletion, infection, psychic causes, polypoid sinusitis, emphysema and foreign bodies. In this intrinsic group they state that the mortality is 7.6 per cent but they do not refer to sudden death and it would appear that most of their fatal cases occur as a result of organic disease. Norris and Landis (1940) state that, "contrary to the older writers, death does not result from uncomplicated bronchial asthma," and they take the view that congestive heart failure or acute respiratory infection are the usual causes of death, although they mention the possibility of obstructive atelectasis. It does not appear, however, from their description that they recognize the sudden type of death which is discussed in this paper.

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Recent studies of fatal asthma have been published by Williams (1953) and by Earle (1953). Williams quotes the Registrar General's figures of deaths from asthma and he presents records of 181 cases of death from status asthmaticus. He suggests that death from this cause occurs predominantly in patients over the age of 30 years and concludes that infection plays a dominant part in the etiology of death from status asthmaticus. Earle finds that "death from uncomplicated bronchial asthma is not so rare as was once supposed. Death usually results from asphyxia produced by excessive mucous secretion blocking the air passages, whereas bronchospasm plays a minor role." He draws attention to the dangers of morphine and aspirin in sensitive subjects. He goes on to state that "some asthmatics die suddenly without sufficient cause being demonstrated at necropsy; vagal inhibition of the heart by physical or psychological stimuli is a possible mechanism." Houston et al. (1953) record a series of nine cases of fatal status asthmaticus, carefully studied at necropsy, from which they conclude that loss of the ciliated bronchial epithelium seems the most probable explanation for the formation of mucus and bronchial obstruction.

Occurrence of a fatal result in status asthmaticus does not come as a surprise or shock to the relatives or to the doctor, because the patient is gravely and increasingly ill over a period of hours or days. During the past few years, however, it has become apparent to the writer that there is a small number of asthmatic patients who die quite suddenly in an attack which does not differ in any respect from the attacks of asthma to which these patients are accustomed. This condition is completely different from that which is termed status asthmaticus. Rubin (1947) describes one such case in which autopsy revealed over-distention of the lungs, with the heart in systole. He also quotes L. Unger who reported an analogous instance in which the findings were very similar. The purpose of this paper is to describe the clinical findings in a series of nine cases of asthma in which sudden death occurred without any satisfactory explanation. It is essential to realize the possibility of such an event, for unexpected death in what appears to be a perfectly innocent condition is liable to come as a great shock to the relatives, particularly if they have been assured that asthma is not a fatal complaint. From the scientific point of view it is necessary for the fact to be placed on record that spasmodic asthma, in itself, is a possible cause of death. Unless this fact is recognized, the medical attendant may be tempted to postulate some additional condition which is known to cause sudden death, such as coronary thrombosis, in order to explain the occurrence but there is no evidence which would suggest that asthmatic subjects are prone to develop coronary disease and the mode of death in patients described here did not suggest coronary thrombosis or, in fact, sudden heart failure. The clinical picture in each case was that of sudden failure of respiration, for which no plausible explanation can be advanced.

The present series consists of a group of nine cases which have been under observation and treatment during the past 10 years. In order to

save space the clinical details are presented in the form of a table and the various factors are considered under the headings suggested by the present writer in a previous paper (1936).

FACTORS CONCERNED IN ASTHMA (9 cases)

| Case No. | Sex | Age of Onset | Age at Death | Total duration of illness | Family History of Asthma | Skin Tests | Upper respiratory tract disease | Broncho-pulmonary changes | Psychological factors | Evidence of heart strain |
|----------|-----|--------------|--------------|---------------------------|--------------------------|------------|---------------------------------|---------------------------|-----------------------|--------------------------|
| 1. | F. | 51 | 51 | 6 mths | + | 0 | 0 | 0 | + | 0 |
| 2. | F. | 54 | 55 | 10 mths | 0 | 0 | 0 | 0 | + | Hypertension |
| 3. | F. | 42 | 44 | 2 yrs | + | 0 | + | 0 | + | 0 |
| 4. | F. | 57 | 59 | 2 yrs | 0 | + | 0 | 0 | + | Enlarged Heart |
| 5. | F. | 37 | 42 | 5 yrs | 0 | 0 | + | + | + | 0 |
| 6. | M. | 57 | 67 | 10 yrs | 0 | 0 | 0 | 0 | + | Hypotension |
| 7. | M. | 47 | 48 | 10 mths | 0 | 0 | + | 0 | + | 0 |
| 8. | M. | 64 | 66 | 2 yrs | 0 | 0 | + | 0 | + | 0 |
| 9. | M. | 47 | 47 | 5 mths | 0 | 0 | + | 0 | + | 0 |

Consideration of this group of cases shows some common factors which may be significant. In the first place the age of onset was confined to patients over the age of 35 years, and it is noteworthy that no less than six died suddenly within two years of the onset of asthma. There was little evidence of an allergic factor; the upper respiratory tract was significantly diseased in six. Careful examination revealed organic change in the lungs in only one.

The heart was examined clinically, radiologically and by the electrocardiogram in each case. Only once was any enlargement found, in a woman aged 57 years; in one there was hypertension and in another the blood pressure was decidedly low (90/55). In none of these cases, however, could there be any suggestion of heart strain leading to sudden death and the state of the circulation was about the same as one would expect to find in any similar group of adults. The most significant feature, shown by the table, is that a distinct "psychological" factor was considered to be present in every case; it is necessary, of course, to be very careful in assessing the significance of a psychological factor in any asthmatic patient unless a full investigation has been carried out in order to determine which other factors are present. In a previous paper (1936) it was considered that there was a significant psychological factor in 74 of a series of 150 cases, so that the presence of a psychological factor in each of these nine patients may be regarded as being noteworthy. In fact, an interesting point emerges from a review of this group. If one considers a large group of asthmatic patients the most striking feature as a rule is the cheerfulness with which the patient faces up to his disability. In the majority of cases the patient makes light of the moderate attack of asthma and carries on with his work in a way which might seem inexplicable to a non-asthmatic person. Each of these nine patients reacted quite differently. In all there was a defeatist attitude almost from the start, and in seven the patients expressed a conviction of impending death. It seems

to be almost certain that this unusual attitude is significant, and it makes one wonder whether as yet we fully understand the mechanism by which life ceases. In four of the cases described here death occurred in the presence of a qualified observer. In each case the event was sudden and completely unexpected, within a few minutes of the onset of what appeared to be an average attack of asthma, and the only apparent explanation in each instance was a sudden failure of respiration. It may also be significant that eight of these patients died at home, and it is possible that the feeling of security conveyed by a hospital and an ever-present nursing staff is an important factor in guarding the patient against an event of this sort. The prevalent feeling in every case was a complete loss of confidence in the future and an entirely hopeless attitude towards life. Consideration of the observations presented here leads to the conclusion that an asthmatic patient who exhibits a pessimistic attitude should be regarded with some suspicion, and the prognosis in such cases should be carefully framed in order to forewarn the relatives that sudden death is a possibility.

It is difficult to see what measures can be taken to support this particular type of patient. Naturally all the usual methods of treatment will be given in the ordinary way, but the results of standard treatment in this series were unsatisfactory. In some ways there is a resemblance to a depressive psychosis, and it might be worth while considering some such treatment as electro-convulsant therapy in the depressed asthmatic. The treatment of the acute emergency depends upon the adoption of instant measures and it is unlikely, therefore, that the opportunity for immediate therapy will often arise. It does not appear that adrenalin is of the slightest value but, if available, the most suitable method from the pharmacological point of view would be the injection of 5 to 7 mls of nikethamide into a vein.

The fact that sudden death may occur as a result of asthma may have some medico-legal importance and, in this connection, one of the cases in this group may be described in some detail. He was an ex-regular army officer aged 47 years. Nasal polypi were removed in 1936, after which there was persistent nasal catarrh, with further operations in 1942 and 1945. In May 1949, he experienced a sudden severe attack of asthma which responded to treatment with adrenalin, but the condition recurred in July and he was admitted to hospital. The asthma recurred at intervals for no apparent reason. The hospital note stated that "although the general condition is satisfactory, the patient has no confidence in himself." It was considered that the psychological state was an important factor in failure of the patient to respond to treatment. He was discharged on 27th September 1949 and he died quite suddenly at home on 1st October 1949. In this case a point of special importance arose. The death certificate stated that the cause of death was "coronary thrombosis" and "status asthmaticus," although the clinical features of both conditions would appear to have been absent. There was no qualified observer present at the moment of death and it is therefore impossible to be quite

sure whether the patient did in fact die from coronary thrombosis, but a consideration of the clinical circumstances does not show any reason to suspect the presence of heart disease, and it appears much more likely that he died from asthma. A claim put forward to the Ministry of Pensions on behalf of his widow was rejected on the ground that coronary occlusion does not bear any relation to asthma and that therefore the cause of death could not in any way be attributed to War Service. In this case there had been a severe degree of nervous strain which preceded the actual development of asthma, and it is probable that this was the most important factor in producing the fatal result. It is open to argument whether the asthma was due to War Service, but the suggestion of coronary thrombosis furnished an effective red herring which obscured the true issues in this case.

SUMMARY

Death may occur quite suddenly in an attack of asthma. Patients who appear to be liable to this disaster are those who develop asthma after the age of 35 years and, in particular, those who exhibit a depressive tendency. When present this tendency should be treated. It is suggested that, in propitious circumstances, an emergency might be met by the intravenous injection of 5 to 7 mils of nikethamide.

RESUMEN

Puede ocurrir la muerte repentina durante un ataque de asma. Son más capaces de sufrir esto, aquéllos enfermos en los que aparece el asma después de los 35 años y en especial aquéllos que muestran unatendencia depresiva. Cuando esta tendencia se presenta, debe combatir se. Se sugiere que en circunstancias propicias se puede hacer frente a esta emergencia por la inyección intravenosa de 5 a 7 miligrs. deniketamida.

RESUME

On peut voir survenir la mort presque subite au cours d'une crise d'asthme. Les malades qui semblent susceptibles d'une telle évolution sont ceux dont l'asthme se constitue après 35 ans, et en particulier ceux qui ont une tendance dépressive. Quand on constate cette tendance, on doit lui opposer une thérapeutique. L'auteur conseille que dans certaines circonstances, il puisse être nécessaire de faire d'urgence une injection intraveineuse de "nikethamide".

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Case Report Section

Selective Pneumothorax: A Complication of Bronchoscopy*

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The occurrence of pneumothorax with mediastinal and, or, subcutaneous emphysema is an infrequent complication of bronchoscopic examination.^{1, 2, 4, 6} The site of rupture of the trachea or main bronchi has been obvious in some, but in others, no cause for this complication has been determined.

The visualization of selective pneumothorax without emphysema as a complication of bronchoscopy has not been previously reported.

CASE REPORT

R. F. (R. No. 3341), a 63 year old Negro male, had shortness of breath and pain in the right chest of two years duration. Symptoms had been intermittent. One year previously he had a small hemoptysis. X-ray film of the chest at that time was reported as negative. Two months previous to present admission he had spit up several teaspoonfuls of bright red blood. The chest x-ray film, at that time, was reported as showing an infiltration of the right upper lobe. He (Fig. 1) was bronchoscoped and no lesion was found, but he was referred for hospitalization.

X-ray film of the chest (Fig. 2) on admission to this hospital revealed pneumothorax selectively collapsing the right upper lobe. He had no symptom referable to pneumothorax. He was rebronchoscoped and again no abnormality was found.

He was explored and on finding a mass in the right upper lobe, pneumonectomy was performed. The surgical specimen revealed a fairly well demarcated, hard, light grey mass arising from the posterior and anterior branches of the right upper lobe bronchus. The mass extended from the point of origin for a distance of 2 cm. along the course of the anterior and posterior branch bronchi. The lumina of these bronchi were constricted but patent throughout. The remaining bronchi and parenchyma were normal, and no point of perforation was visualized. The pathological report was bronchogenic carcinoma, oat cell type.

Comment

Selective pneumothorax, as defined by Coryllos,³ means the tendency of air introduced into the pleural cavity to locate itself around the diseased parts of the lung. The explanation of this process by Hurst and Miller⁵ in tuberculosis, where it is the aim of pneumothorax therapy, assumes the

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involvement of the bronchus by tuberculosis or its effects, such as edema, extrinsic pressure, etc. Then, the induction of the pneumothorax reduces the normal lengthening and shortening, and dilatation and contraction of the bronchi, and tends to completely occlude the bronchial lumen and atelectasis follows.

Selective pneumothorax, or its resultant selective collapse, is usually not considered in bronchogenic carcinoma. The position of the tumor abutting on the upper lobe bronchi, as seen in the surgical specimen, reducing the lumina but not occluding them is then analogous to the conditions in tuberculous selective pneumothorax and the explanation of the mechanism in the case presented is probably the same.

When pneumothorax with its accompanying emphysema occurs as a complication of bronchoscopy, symptoms are usually severe, and require treatment. In this case the patient was asymptomatic, and the pneumothorax was discovered on roentgen examination after the bronchoscopy. Hence, if one considered selective pneumothorax as a sign of pathology in the lung, it might be thought of as a fortunate bronchoscopic complication in this case leading to earlier thoracotomy.

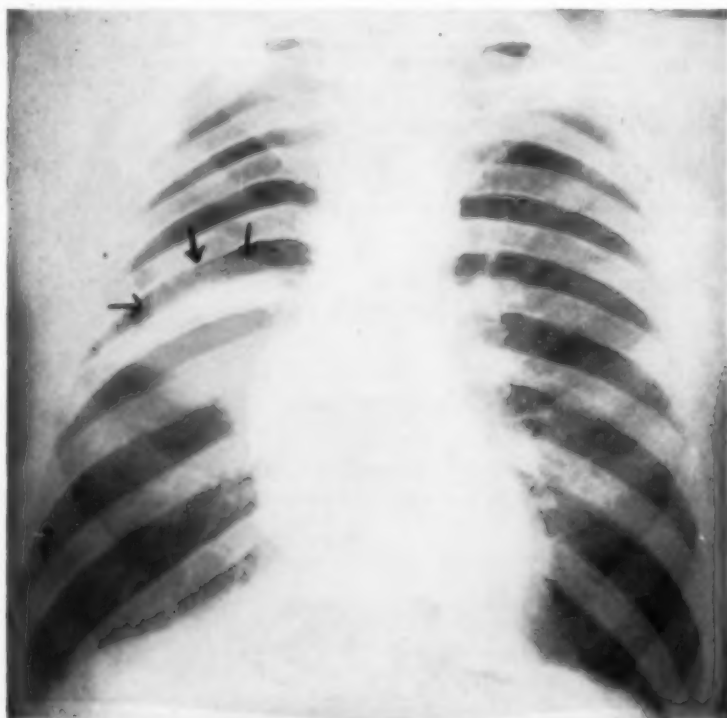


FIGURE 1: Chest roentgenogram visualizes selective pneumothorax with complete collapse of the right upper lobe.

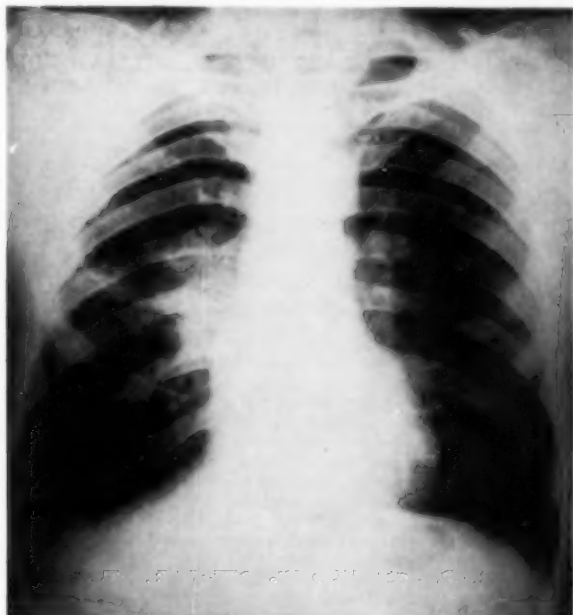


FIGURE 2: Chest roentgenogram demonstrates an infiltration in the right hilum and right upper lobe.

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Plasma Cell Granuloma of Lung*

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A survey of the recent literature on the subject of extramedullary plasma cell granuloma of lung reveals this article to be the third published report dealing with this type of pseudotumor. Childress and Adie¹ in 1949 and Cotton and Penido² in 1952 have preceded our own presentation with examples of a similar lesion encountered in their own patients. The lesion which we report is then not only of rare occurrence but appears to be the largest of its type so far described in publication.

Case History

K. W., a 28 year old white male, ship electrician, had suffered from persistent, moderately severe cough, productive of one ounce of semi-mucoid sputa from April to June 1951, and related one episode of minimal hemoptysis in June 1951. He had incurred no significant weight loss. While in the Canal Zone in June 1951, he was informed, following a pre-employment examination, that his chest film showed a tumor in the left pericardial region and a tuberculosis-like infiltrate in the left apex. He promptly returned to his home in Portland, Maine, and was studied while hospitalized there at the United States Public Health Service Hospital from July 10, 1951 to August 30, 1951. Gastric cultures for acid fast bacilli were negative. He remained on out-patient status for four months and was then admitted to the Tumor Clinic, United States Public Health Service Hospital, Baltimore, Maryland for excision of the tumor in the left lower thoracic cavity. Because preoperative sputas showed tubercle bacilli on smear and because it was felt prudent to obtain stabilization of the tuberculous process before attempting left thoracotomy, he was transferred to the U.S.P.H.S. Hospital, Manhattan Beach, New York, where he remained from February 15, 1952 to August 1952. The February 1952 chest x-ray film showed a normal right lung; in the left lung field were a fibro-exudative infiltrate in the first and second anterior interspaces and a large mass in the posterior inferior region of the pleural cavity. Tomograms revealed a small cavity in the apical-posterior segment of the left upper lobe. Streptomycin grams one every other day and PAS grams daily were begun February 20, 1952, INAH 300 mgm. daily started August 4, 1952 and these drugs have been maintained without interruption to the present time (January, 1953).

Past history: No member of his family was known to have had tuberculosis. He further stated that as part of his duties as a ship electrician from July 1950 to March 1951 he would remove accumulated dust from the carbon brushes of the ship generators periodically, an act which caused some irritation of the naso-pharynx. During the years 1948 to 1950 he worked as a hardware salesman, spending a great deal of his time in the San Joaquin Valley, California, but he had felt in good health during this period. An earlier chest film in June 1950 was reportedly negative. However, it is quite possible the tumor was so small at that time that its presence on a posterior-anterior projection was concealed by the then larger cardiac silhouette.

By August, 1952 the left apical cavity had closed the left upper lung infiltrate had sufficiently cleared and stabilized. He was transferred to the U.S.P.H.S. Hospital, Staten Island for left thoracotomy. He was well-developed and presented no significant abnormality on physical examination—even of the chest. Blood pressure 106/60.

Laboratory work (prior to surgery): Leukocyte count 7500. Hemoglobin 15. Routine urine analysis was normal. VDRL and Mazzini—negative. Sputa smears—negative for acid fast bacilli. Barium swallow showed no esophageal abnormality, no evidence of hiatus hernia (see figures 1 and 2). Electrocardiogram showed non specific T and ST wave changes—suggesting an abnormality localized to the posterior myocardium or pericardium. Histoplasmin and coccidiodin skin tests were negative.

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It was the impression of the surgeons that the upper lobe infiltration was tuberculous and that the mass in the lower lung field was a benign tumor. Left thoracotomy was performed on August 28, 1952. The upper lobe collapsed readily but the lower lobe maintained most of its configuration. Throughout the upper lobe could be palpated aggregates of nodular disease most numerous in the apical-posterior segment, presumably tuberculous. Occupying the central portion of the lower lobe was a firm, multilobular mass which displaced and compressed adjacent lung parenchyma in some areas and in others presented a glistening, yellow appearance beneath the visceral pleura. The inferior pulmonary ligament was abnormally and highly vascularized. Several small mediastinal nodes were present. Left lower lobectomy was performed and to prevent overexpansion of the residual lobe a tailoring thoracoplasty—periosteal, stripping of ribs one and four, resection of postero-lateral portions of ribs two and three—was completed. The postoperative course was uneventful and he made a rapid convalescence.

Gross description of the excised specimen: Specimen consists of a lower lobe of lung which weighs 380 grams and measures 14.5 x 6.5 x 9.0 cms. Pleural surfaces are smooth and glistening. There is a well circumscribed but unencapsulated 9.0 x 5.0 x 4.0 cms. dumb-bell shaped firm tumor mass occupying the lower two-thirds of the lung. The surrounding lung tissue is compressed but otherwise appears normal. The tumor shows no intimate relationship to adjacent lung parenchyma or regional segmental bronchi. When removed from lung it weighs 198 grams. It is fibrocartilagenous in consistency and cuts with a firm, gritty resistance. The cut surface bulges slightly and appears somewhat whorled, and is white to cream-tan in color. No major vessels are seen leading to tumor or are lying on its cut surfaces. Minute spicules of ossified material occur in its central portion. Several submitted lymph nodes (hilar) measure up to 0.4 x 0.4 x 0.6 cm. and are fleshy on cut surface. Note figure 3.

Microscopic description: Sections show neoplasm which is well separated from adjacent normal lung parenchyma but lacks a definite capsule. Within tumor there are nests and cords of cells resembling predominantly plasma cells admixed with lymphocytes. Such areas are surrounded by dense, fibrous connective tissue bands. No major blood vessels are seen histologically. Some sections reveal small areas of calcifications within dense fibrous connective tissue. The sectioned lymph nodes reveal mild chronic reactive hyperplasia. Figures 4 and 5.

Additional studies were made postoperatively because the unusual gross and microscopic characteristics of the tumor suggested kinship to other diseases of tumoral, metabolic, or inflammatory etiology. Skeletal survey of skull, spine, and long bones showed no abnormality. Urine showed no Bence-Jones protein. Cholesterol determinations were within normal limits. Acid phosphatase 0.2 B. U. Alkaline phosphatase 2.8 B. U. Total protein 8.2 grams per cent. N. P. N.—48 mgm. per cent. Aspiration from the right iliac crest revealed normal bone marrow.

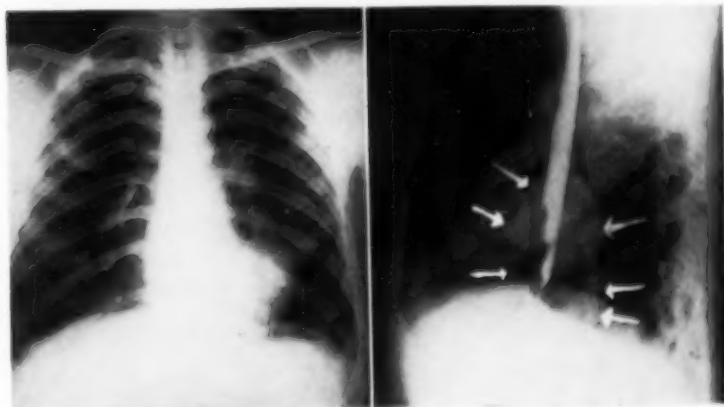


FIGURE 1

FIGURE 2

Figure 1: In this pre-operative chest film note the density lateral to the left cardiac border.—Figure 2: The esophagus is visualized by barium. The arrows indicate the extent and location of this lesion.

He is still in the hospital (January, 1953) receiving appropriate therapy and making satisfactory progress in overcoming pulmonary tuberculosis. The operative procedure had no detectable adverse effect upon the status of this disease.

Discussion

In a comprehensive review of the literature, Hellwig³ in 1943 reported 127 cases of extramedullary plasmacytoma to which he added one of his own. In a personal communication Dr. F. W. Stewart mentioned to him that he had observed two others. Of these, 110 occurred in the air passages and conjunctiva, however, they may occur in the digestive tract or soft regions of the body. Although they are usually single, they may be multiple. Often they are benign and do not lead to metastases except in rare cases to regional lymph nodes. Histologically, plasmacytomas have

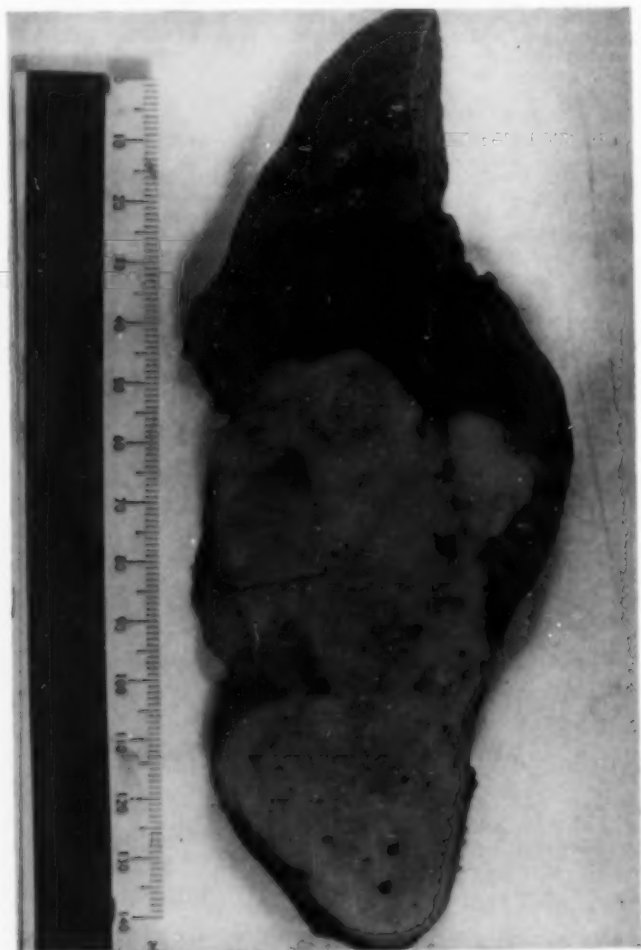


FIGURE 3: Gross appearance of tumor occupying $\frac{2}{3}$ of left lower lobe.

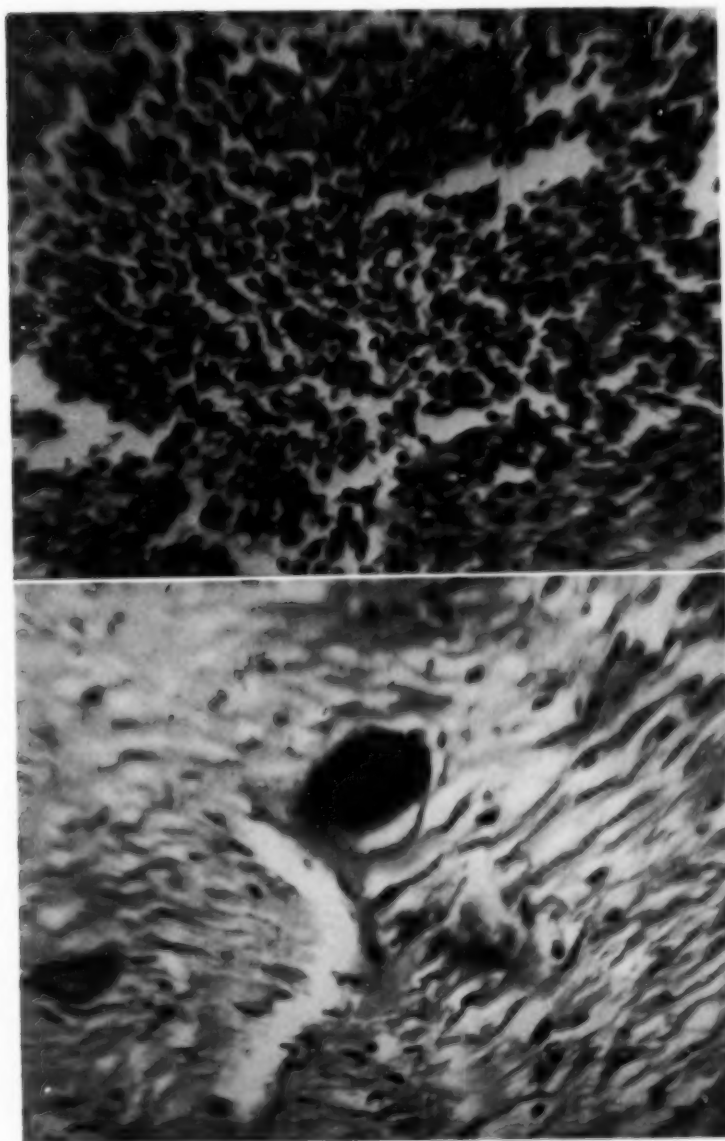


FIGURE 4, *above*: Areas of tumor with nests of round cells in which plasmal cell predominates. H & E stain high dry power field.

FIGURE 5, *below*: Areas of calcification in dense fibrous connective tissue within tumor. H & E stain. 400x.

the appearance of true primary tumors consisting solely of plasma cells. This type can be classified as a plasma cell tumor. Another type which has been described consists mainly of plasma cells, but lymphocytes, leucocytes, and fibroblasts are also present. This form should be differentiated from the tumoral type and preferably should be considered a plasma cell granuloma.⁴ The latter occurs in areas of focal infection. The presence of plasma cells in chronic inflammatory conditions is well known.

Xanthomatous tumors are distinct both morphologically and histologically from plasmacytomas being characterized by the presence of foam cells in addition to chronic inflammatory cells. Grossly they are golden-yellow. The isolated xanthomata of lung reported by Scott⁵ in 1948 and Ford⁶ in 1950 showed no abnormality in the serum cholesterol. Although the diagnosis of xanthoma was not entertained in our case, we point out that our patient's cholesterol and cholesterol esters were within normal limits. No foam cells were seen in our lesion.

Plasma cells in plasmacytoma resemble myeloma cells. They have characteristic excentric nuclei which reveal clumped chromatin in a cartwheel like appearance.

The cytoplasm is mildly to strongly basophilic. The origin of the plasma cell is in dispute but the concept gaining widest acceptance is that these cells arise from the myeloid tissue in the myelomas or from lymphatic tissue in the case of the extramedullary plasmacytoma and inflammatory disease; the stem cells in either case are the reticulo-endothelial cells. Multiple myelomas invariably and extramedullary plasmacytomas commonly are attended by an upset in the serum protein balance of the blood due to an increase in serum globulin. Our patient showed normal serum protein levels and a normal A/G ratio. At no time did he have albuminuria or Bence-Jones protein in the urine. Postoperative skeletal roentgen studies failed to reveal any pathology which would suggest myeloma.

Special stains failed to reveal specific organisms—namely fungi, bacteria, or acid fast bacilli. The supposition that this lesion is a coccidioidal granuloma can be eliminated because of the negative coccidioidin skin test and the absence of endosporules in tissue sections. The negative venereal disease history and negative serology exclude the possibility of a luetic gumma. The coincidental occurrence of active pulmonary tuberculosis in the left upper lobe suggests tuberculosis as the specific etiologic factor. However, smears and cultures from the excised lesion were negative, and the histologic picture was not characteristic for tuberculosis.

We regard the lesion described herein as a plasma cell granuloma of nonspecific inflammatory origin because of its variable composition with a preponderance of plasma cells.

SUMMARY

We regard the lesion described herein as a plasma cell granuloma of lung treated by lobectomy. The pseudotumor itself weighed 198 grams, measured 9 x 5 x 4 cms., and is the largest of its type thus far reported in the literature.

RESUMEN

Presentamos un caso de "plasma cell" granuloma extramedular del pulmón tratado por lobectomía. El seudo tumor pesaba 198 gramos, medía 9 x 5 x 4 cms., y es el mayor de su tipo hasta hoy relatado en la literatura.

RESUME

Les auteurs rapportent une observation de granulome à cellules extra-médullaires du poumon, traité par lobectomie. Cette pseudo-tumeur pesait 198 grammes, mesurait 9 x 5 x 4 cm. et est la plus volumineuse de ce type qui, jusqu'à présent, ait été rapportée dans la littérature.

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Treatment of Air Embolism in Pneumoperitoneum

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Since the introduction of pneumoperitoneum as an adjunct in the treatment of pulmonary tuberculosis by Banyai in the early 1930's, this procedure has assumed great popularity in the various chest clinics throughout the country. Pneumoperitoneum has proved to be beneficial in bilateral pulmonary tuberculous lesions whether in the apical or basal segments of the lungs. It has been satisfactorily used as an adjunct in improving the patient's condition so that surgery, not feasible at the moment may be performed subsequently. It has also been applicable to patients who are not eligible for other types of mechanical therapy either because of age, general debilitation or because of low vital pulmonary capacity.

At Kings County Hospital, a large general city hospital of 3000 beds, of which 700 are used exclusively for pulmonary tuberculosis, pneumoperitoneum is one of the frequently used forms of therapy both on the wards and in the clinics. The out-patient department of the tuberculosis clinic treats approximately 30 patients daily by pneumoperitoneal refills. This has been used for years without fatality. However, with such procedure as pneumoperitoneum, the thought of air embolism is ever present. With this in mind the following case is presented.

A. L., a Negro female, age 35, was discovered to have pulmonary tuberculosis in November 1947. She was admitted to Kings County Hospital for her attacks of bronchial asthma, weight loss (20 lbs.), anorexia and night sweats. Her past history was essentially negative. Her mother and father both died from pulmonary tuberculosis and her daughter had this disease. Her husband was alive and well.

X-ray film inspection in November 1947 revealed, "Caseous pneumonic tuberculous infiltration of the right upper lobe with a cavity size of 1 cm. in diameter. There is an exudative spread noted in left mid lung field." Sputum was positive for acid fast bacilli and she was placed on bed rest and dihydrostreptomycin. In June 1948 her left lung field cleared and in August 1948 pneumothorax was instituted on the right side which was discontinued in February 1949 because of right pleural effusion. In March 1949 pneumoperitoneum was instituted with good results. She was discharged to the out-patient department on September 26, 1950 for weekly refills of air (500 cc.) which were given in the right upper quadrant of the abdomen to maintain an adequate rise of the diaphragm.

On December 20, 1951 after she was fluoroscoped and found to have adequate space, a blunt 19 gauge needle was inserted into the abdominal cavity in the right upper quadrant. The syringe was manipulated and no blood was obtained. The manometric reading was plus four.

At the close of the treatment in which 500 cc. of air had been instilled, she became breathless, her eyes rolled to one side, the pulse became imperceptible and she became comatose. She was immediately placed in the left lateral position after the procedure described by Durant.¹ Within several minutes the pulse became stronger, the blood pressure started to rise, although she still remained unconscious for three quarters of an hour and had incontinence of urine and feces. Within this 45 minute period she revived and was admitted to the hospital. There was no evidence of neurological signs. Her reflexes were normal.

She was discharged from the hospital on December 22, 1951 at which time she complained of numbness from her diaphragm to her extremities. Since then her numbness has disappeared. In her own words before she became unconscious she said, "I felt air going around in a circle and then I passed out."

From the Medical Service of Dr. Charles Hamilton, Kings County Hospital.

Comment

In pneumoperitoneum air embolism occurs as a result of the entrance of massive quantities of air into a systemic vein which is transported to the right heart and thus produces an acute mechanical obstruction to the outflow tract of the right ventricle. Durant has proved by experimental procedures on dogs that the obstruction of the outflow tract of the right ventricle due to air embolism can be relieved by placing the individual in the left lateral position, so as to allow the air mixed with the blood to churn into froth. Thus the blood is transported into the lungs where excretion occurs. The procedure as described by Durant was the one used in the above case. Our patient did not receive any other form of therapy such as oxygen or stimulants.

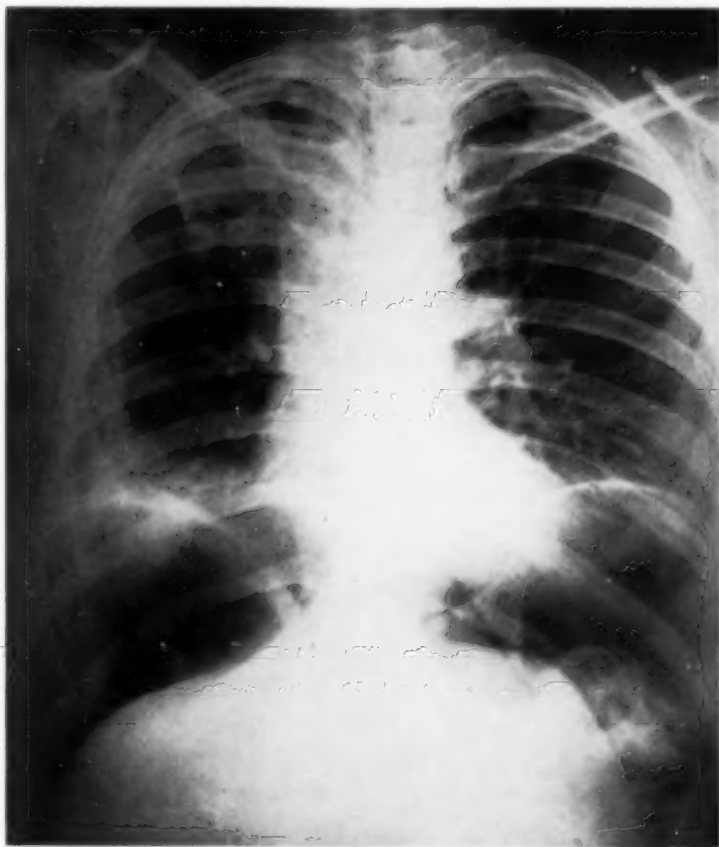


FIGURE 1

SUMMARY

1. A case of air embolism has been presented with treatment after that described by Durant.

2. This procedure described by Durant and his associates in placing the patient in left lateral position after venous air embolism should be constantly in the minds of those clinicians who give pneumoperitoneum treatments, in order to avoid fatalities.

RESUMEN

1.—Se presenta un caso de embolia gaseosa en el que se empleó el tratamiento descrito por Durant.

2.—Este procedimiento descrito por Durant y sus asociados consistente en colocar al enfermo en decúbito lateral izquierdo cuando ocurre la embolia, debe tenerse siempre presente por los clínicos que hacen neumoperitoneo a fin de evitar los casos fatales de embolia.

RESUME

L'auteur présente un cas d'embolie gazeuse dont le traitement a été institué selon la technique de Durant.

Cette méthode qui consiste à placer le malade en position latérale gauche après embolie gazeuse d'origine veineuse, devrait être constamment présente à l'esprit des cliniciens qui pratiquent des pneumopéritonéiques afin qu'ils puissent éviter les accidents mortels.

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Cavitation in Metastatic Pulmonary Neoplasm

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Necrosis and cavitation are a frequent occurrence in primary tumors of the lung.^{1, 4} However, pulmonary cavitation of a metastatic nodule in the lung is rare. Dolgoff and Hansen⁵ in a survey of the literature did not find a previously recorded example of such an occurrence. Others^{6, 7} however, have reported cavernous lesions in metastatic carcinomas. More recently⁸ two additional cases were reported, showing multiple cavitation. The following case is described in order to call attention to metastatic disease in the differential diagnosis of pulmonary cavities.

A. Z., a dentist, age 66, was admitted to the Jewish Memorial Hospital on April 5, 1951, with the history of acute upper respiratory infection for seven weeks prior to admission. This was accompanied by slight cough with scanty expectoration, and sore throat. He ran a low-grade fever up to 102° for several days prior to admission. His presenting complaint was that of extreme weakness and dizziness. He further complained of increased constipation and black stool, and weight loss of 12 lbs. He had been operated upon at the Mt. Sinai Hospital, New York City, eight years before for obstructing adenocarcinoma of the transverse colon.

Physical examination revealed a middle-aged white male who appeared chronically ill. There was dullness over the upper lobe of the right lung, with occasional scattered rales over both bases. Examination of the heart was negative. Liver, kidney and spleen were not palpable. There were no palpable glands. Blood count on admission showed hgb. 6.5 gm., red blood cells 1,900,000, with achromia, anisocytosis and microcytosis. A sternal marrow puncture was done two days after admission. This revealed a myeloblastic picture.

Roentgenological examination revealed multiple nodular lung densities with atelectasis. The hilar glands were enlarged and the right upper lobe showed a pneumonic density suggestive of atelectasis, at the outer aspect of which a cavity could be seen (Fig. 1).

He developed epistaxis and transfusions were given. His condition became worse, and despite supportive measures, he died three weeks after admission. Three days before death, he developed an enlarged spleen and petechiae. The white count rose to 129,000 and the platelets fell to 70,000.

The following pertinent necropsy findings were noted in the lungs:

The left lung was aerated and on cut section showed several discrete rounded nodular tumor masses with marked central necrosis. The right lung was bulky. The right upper lobe was taken up by a large solitary nodular rounded tumor mass with marked central cheesy necrosis measuring 4 cm. in diameter. The right middle lobe showed a similar solitary nodular tumor 1½ cm. in diameter.

Microscopic examination showed invasion and replacement by markedly atypical glandular epithelium with marked disorientation of the nuclei. Extensive secondary degeneration and necrosis was present. Other section showed extensive intraalveolar mononucleosis and heart failure cells with septal and alveolar elements. Some sections showed extensive pneumonic infiltration with surrounding hemorrhage and necrosis of lung parenchyma. Other sections showed extensive interstitial leukemic infiltrations consisting of very young large myeloid cells.

Summary of autopsy findings: Metastases to the lungs from a primary adenocarcinoma of the transverse colon in a patient who developed a superimposed acute leukemia.

From the Department of Pulmonary Diseases, Jewish Memorial Hospital, N. Y.

The authors thank Dr. Milton A. Miller for permission to publish this case.

Attending Physician (Dr. Bass).

Adjunct Physician (Dr. Katzev).

Comment

The case of Dolgoff and Hansen showed that cavity formation was due to expectoration of a fragment of tumor tissue. In our case, extensive degeneration and necrosis was present in the metastatic nodular tumor in the lung. The primary neoplasm was adenocarcinoma of the transverse colon which had been resected eight years before. Solitary pulmonary metastasis nine and one half years after resection of a colon carcinoma has been previously reported.⁹

The rare occurrence of cavitation in metastatic pulmonary nodules may be due to the shortened life of patients with metastatic lesions. But in this era of extensive antimicrobial therapy, when the duration of life may be extended for a much longer period, more cases of this kind may be expected.

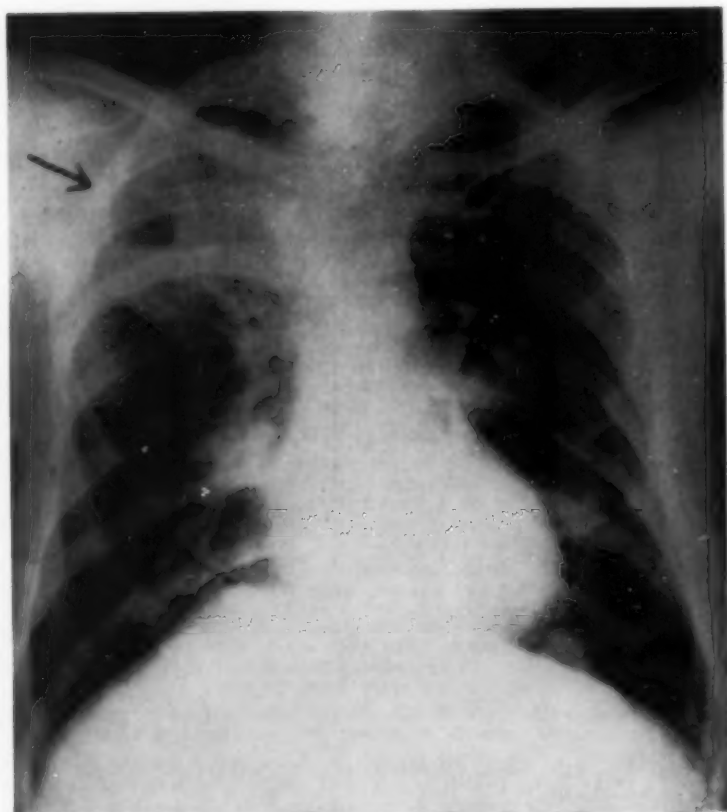


FIGURE 1: Large cavity in right upper lobe with fluid level. Rounded densities are also seen in both lower lung fields.

SUMMARY

1. A case of cavitation in a metastatic pulmonary neoplasm has been described.

2. Metastatic disease should be considered in the differential diagnosis of pulmonary cavitation.

RESUMEN

1. Se describe un caso de neoplasia metastática pulmonar excavada.

2. La metástasis neoplásica, debe tomarse en cuenta en el—diagnóstico diferencial de la excavación pulmonar.

RESUME

Les auteurs décrivent un cas de métastase néoplasique pulmonaire dans laquelle s'est creusée une cavité.

Il faut envisager le cancer secondaire quand on discute le diagnostic des cavernes pulmonaires.

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Editorial

ISONIAZIDS VERSUS STREPTOMYCIN

A critical appraisal of the use of isoniazids versus streptomycin has been difficult to evaluate. Everybody is willing to admit that both the chemical drug and the antibiotic are wonderful adjuvants in the treatment of tuberculosis. An attempt has been made to compare the results of the treatment with isoniazids or streptomycin in a mass survey of patients treated in various institutions. Such a comparison immediately brings up the question of the variations in the duration and the character of the pulmonary disease, and the dosage used. Results would not be uniform if too low or too large a dose was used.

Direct comparison of cases is not the answer! Isoniazids had many successful results in streptomycin failures. Isoniazids alone, or with synergists, appear to have good results. There should not be an impression that streptomycin may have a kindred value to isoniazids for streptomycin is less certain of obtaining an arrest of the tuberculous disease.

However, physicians are being advised that streptomycin and para-aminosalicylic acid are the drugs of choice, and if the patient does not respond well, then isoniazids should be used. Unfortunately, because of the better results in isoniazids, this 'wait and see' policy is wrong. The 'wait and see' period is about six months, and in that time the disease might very well have been controlled with isoniazids.

Isoniazids do well alone, and better with synergists. If isoniazids are used, the synergist of choice is dihydro-streptomycin or streptomycin. Remember, the antibiotics are used, though alone they are more apt to be failures. The antibiotics are really synergists, increasing the action of isoniazids over what it may accomplish alone. The next synergists are PAS and terramycin but to a lesser extent than dihydro-streptomycin and streptomycin.

The arrest of tuberculosis is the goal in treatment. Collapse therapy (pneumothorax or pneumoperitoneum, when indications require such treatments) used simultaneously with isoniazids and synergists should begin on the same day.

Our interest is not to determine which form of therapy could be responsible for the arrest of the disease but just to accomplish such an arrest.

George G. Ornstein

Teaching Chest Disease*

The Importance of the Physiology Laboratory in the Teaching of Diseases of the Chest**

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Pulmonary physiology is divided into clinical and theoretical fields of study more sharply than almost any other medical specialty. It originated as a theoretical study at least 75 years ago, during the last half of the nineteenth century, in the many basic observations on the mechanics ventilation recorded by physiologists in France and England. The development of chemical methods of analysis in the first quarter of this century, by Van Slyke, Henderson, Haldane and others, was revolutionary, making possible vast strides in our knowledge of the behavior of blood and alveolar gases. During the last 25 years, our understanding of pulmonary physiology has been consolidated and expanded. The development and refinement of new techniques of investigation, upon which theoretical physiology depends, has been carried on by Cournand, Richards, Riley and a host of other scientists.

This has been inevitably a process of specialization, accompanied by the gradual growth of concepts and terminology peculiar to itself. As a result, the literature on pulmonary physiology is formidable. It is also apt to appear to be somewhat remote from clinical medicine. Papers on detailed techniques of study are of great interest to physiologists but they make the clinician feel that the subject is so complicated that he cannot understand it, and that the facilities for such study are not generally available anyway.

Meanwhile, pulmonary physiology has become a subject of great clinical importance recently, with the advances of thoracic surgery. Its significance was underlined by the discovery that an operation which was life-saving for one patient might turn another into a complete respiratory cripple. At the present time, almost every patient considered for thoracic surgery should undergo a series of tests of pulmonary function. The results of such studies will affect the kind of surgery to be undertaken, the limitations upon excision which must be observed, or even be in themselves an absolute contraindication to any surgical procedures on occasion.

In response to this need for regular clinical evaluation of pulmonary function, simple methods of clinical assessment have been developed by Waring, Gaensler and others. These tests were devised for ease of administration and interpretation and simplicity of equipment. The theoretical work of Cournand, Richards and many others was of great value

*The second in a new series of articles prepared under the sponsorship of the Council on Undergraduate Medical Education of the American College of Chest Physicians.

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in the development of these simplified procedures, particularly in providing scientifically-determined limits of normality against which the amount of dyspnea in any individual case could be accurately estimated.

In the last five years, the clinical application of pulmonary function tests has been greatly extended. They can be of nearly daily service to any physician in his treatment of chronic lung abnormalities, such as emphysema and pulmonary fibrosis, since they are almost the only way of objectively estimating the efficacy of drugs and other therapeutic procedures upon dyspnea. Beyond this, such tests can be of great use in diagnosis, since they provide information as to the type of functional disability resulting from a given pulmonary lesion.

This further clinical application has been made the question of simplicity and inexpensiveness of equipment even more important. It is now apparent that a useful laboratory requires small expenditure. Some kind of low-resistance spirometer, gas meter, Douglas bag and appropriate valves and connections can provide all the basic information that is usually required, although further equipment may be useful even in daily office routine.

In medical school one cannot of course, ignore either of the directions of pulmonary physiology, the theoretical or the clinical. But we believe that the emphasis must be upon the latter. A competent clinician should know enough about the more complex functional tests to make use of the information that they can provide, although he will rarely be called upon to administer such tests himself. On the other hand, the information to be obtained from the use of simple procedures will be adequate in the great majority of cases. After all, one does not think of cardiac catheterization, ballistocardiography and angiocardiogram in physiologic evaluation of the average case of cardiovascular disease. One uses simple physiologic studies of blood pressure, heart rate, vital capacity, exercise tolerance, body weight and other readily measurable phenomena. Pulmonary physiology should be taught in the same way. In the average dyspneic patient we do not measure gradients for oxygen, venous admixtures and so forth but can obtain basic information by simple ventilatory studies. The student should be trained to think of pulmonary physiology as an integral aspect of his practice of clinical medicine.

Students at the University of California School of Medicine are expected to master the basic principles of pulmonary physiology during their general physiologic training period, and in special courses in cardiology. From the beginning, clinical application is stressed and clinicians take part in the presentation of the normal academic course.

Students are then introduced to the clinical physiology laboratory during their later years of training. This laboratory is operated in connection with the University Tuberculosis Division, which maintains about 200 beds. While on the service the students see demonstrations of pulmonary function studies and are encouraged to act as "guinea-pigs" to see how the tests work. They also attend ward conferences on medical and surgical patients on whom studies have been done. Physiologic considerations

are stressed in these conferences. There are formal discussions of problems of dyspnea from the basic physiologic as well as clinical point of view, together with practical demonstrations of newer aids in treatment, such as intermittent positive pressure breathing. They follow lesions in their clinical progress and correlate this progress with physiological consequences by means of repeated pulmonary function tests. Therapy is evaluated in the same way. Thus, it is hoped, students will learn to integrate bacteriological, pathological and clinical findings into a broad understanding of symptoms, including dyspnea, in relation to the impaired function which is their origin.

We believe that teaching chest disease has many facets, none of which can be neglected if training in total patient care is to be our aim. The great effort of medical schools today is to translate the theoretical into the practical. Bacteriology is taught in the laboratory and clinical epidemiologic problems in the wards. Pathology is taught at the microscope and translated at the bedside into an understanding of the tissue changes underlying clinical states. Anatomy is taught in the dissecting room and applied in clinical interpretation of x-ray films. As with these older established fields, so physiological tests are conceived in the laboratory and developed into aids for the greater clinical understanding of the disease processes underlying such symptoms as cough and dyspnea. Thus physiological tests contribute to the broad outlook on disease which is one of the distinguishing characteristics of modern medicine.

The President's Page

THE COMMON BOND

The first cry of pain at the dawn of time brought from the victim's fellowman an expression of concern for the relief of the individual in distress. This concern for the welfare of a fellowman is a dominant characteristic of the human race.

The care and attention given to the ill or injured in early times were crude and were, at times, ineffectual; but, each succeeding experience afforded an increasing fund of knowledge concerning the ailments to which man was subject. Some men were more adept in their administrations and through service developed a better understanding of the various ailments with which man was afflicted; they came to be known as physicians.

Physicians found it helpful to discuss their problems with similarly minded men of their community. In time, information was exchanged with men outside the immediate neighborhood; and, finally, the physician found himself traveling into distant lands in search of knowledge and skills, to be used in the care of the sick and injured at home. This search for information often took the physician into enemy countries. The appeal of the sick and injured was the foundation for the development of a universal understanding and common purpose for all physicians. Friend and foe could meet on this common ground without the introduction of discordant matters. A liberal exchange of medical knowledge and skills between physicians has always prevailed. It has been the usual custom for physicians to treat friend and enemy alike, there being no limit to the bounty of their services.

The American College of Chest Physicians was founded by a group of physicians who were motivated by the same compelling urge as their forefathers to search for means to better serve mankind. They sought to make available for the physicians of their communities, knowledge and information regarding diseases of the chest and thereby to increase their capacity for service. Throughout the years this ideal has continued to be the fixed purpose of those who make up the college.

To further promote the free exchange of knowledge and skills, concerning diseases of the chest between physicians on a world-wide level, an "International Congress on Diseases of the Chest" was organized. No political nor geographical boundaries were to limit the exchange of knowledge.

The first International Congress on Diseases of the Chest was held in Rome, Italy in 1950. At this congress we participated in a liberal exchange of knowledge and skills between physicians from all over the world. Each returned to his homeland with the conviction that he could better serve his fellowman at home as a result of the liberal and unselfish exchange of information that had taken place at Rome. Each returned home a little less ready to condemn what might have been considered short-comings of his fellow physicians and, with a better understanding of the medical problems of his conferees in other lands. The universality of the language (cry) of the distressed, as it is interpreted by the physician, has been reaffirmed at the Second International Congress in Rio de Janeiro and, more recently, at the Third International Congress in Barcelona, Spain. Many physicians traveled thousands of miles to attend these International Congresses. No patents nor copyrights interfered with the liberal exchange of medical information. Each physician gave freely of his knowledge and skills. Meeting as we did on a common ground of mutual accord to discuss matters universal in their appeal has resulted in a better understanding between individuals of many lands.

The friendships which have developed through these meetings are solid and enduring. Political and geographical boundaries may restrict physical contact between physicians but their unselfish service to humanity is creating an enduring monument to physicians and to the invisible but strong bonds which unite them in their common purpose of improving and expanding service in the relief of afflicted humanity.

William A. Hudson

Outstanding Scientific Program for 21st Annual Meeting

Dr. Burgess L. Gordon, Philadelphia, Chairman of the Committee on Scientific Program for the 21st Annual Meeting of the American College of Chest Physicians, has announced that the program is in its final stages of completion and will be available for publication in the March issue of *DISEASES OF THE CHEST*. Be sure to look for the final program in the March issue. The annual meeting will be held at the Ambassador Hotel, Atlantic City, New Jersey, June 2 through 5, 1955.

Many innovations, which are certain to be of unusual interest to our members, have been made in the program this year. There will be a number of panel discussions and considerably more than the usual amount of time for discussion from the floor has been planned. Prominent speakers will present concise reports of their studies in special fields such as cancer, emphysema, pulmonary and cardiac function, heart and thoracic surgery, tuberculosis and nontuberculous diseases of the chest, industrial diseases, and many others, and the question-and-answer periods will be open to all interested physicians.

On Friday evening, June 3, the "Fireside Conferences" will be held with more than thirty subjects to be discussed, covering a wide range of almost every conceivable aspect of chest disease—more than enough to interest everyone—with refreshments to assist in keeping the discussions going. An outstanding scientist will lead the discussion of each subject and hosts will be on hand to direct and introduce, and generally aid in engendering the feeling of good fellowship.

The first "Selman Waksman Lecture," sponsored by the New Jersey Chapter of the College, will be presented on the opening night of the meeting, Thursday, June 2, and the guest speaker will be Sir Geoffrey Todd, Medical Director of the King Edward VII Sanatorium, Sussex, England, an outstanding authority. His subject will be "Modern Concepts of Tuberculosis."

A Diagnostic-Treatment Conference will be presented on Saturday afternoon, June 4. Members will have the opportunity of selection from a group of six popular round table luncheon discussions to be presented on each of three days of the meeting, Friday, Saturday and Sunday, June 3, 4 and 5. Motion picture sessions on diseases of the chest will be presented concurrently with the scientific sessions on these days.

Examinations for Fellowship in the College will be held on Thursday, June 2. The annual Seminars, which have been accredited by the Board of Examiners for candidates for Fellowship in the College, will be presented on Wednesday, June 1.

Meetings of all councils and committees of the College will be scheduled for Thursday, June 2, at the Ambassador Hotel. Members of the College councils and committees are urgently requested to make plans to attend these important meetings.

Honorary Fellowship in the College will be conferred upon a number of prominent scientists at the annual Convocation to be held on Saturday evening, June 4. This will be followed by a cocktail party and the Annual Presidents' Banquet. There will be no speeches. Dancing and good fellowship will conclude the evening.

Mrs. Irving Willner, Newark, New Jersey, Chairman of the Ladies Reception Committee, has announced that there will be an enjoyable program of events for the ladies attending the meeting.

A hotel reservation form may be found on page xvi of this issue of the journal and it is suggested that this form be mailed at once to the Ambassador Hotel. Reservations will be accepted in the order in which they are received and to be assured of accommodations for the meeting at the headquarters hotel, it is advisable that you fill out the coupon and mail it today. The American Medical Association will meet in Atlantic City, June 6-10, 1955. The Section on Diseases of the Chest will meet on June 7-8-9. When completing your hotel reservation form, please give arrival and departure dates.

College Interim Session

More than 250 physicians and guests were present in Miami Beach, Florida, on Sunday, November 28 for an excellent scientific program sponsored by the Florida Chapter of the College. The chapter also sponsored a cocktail party on Sunday evening, followed by a dinner presided over by Dr. Alexander Libow, Chairman of the Scientific Program Committee. Dr. Libow introduced Dr. William A. Hudson, President of the College who spoke on the Third International Congress on Diseases of the Chest held recently in Barcelona, Spain. Dr. M. Jay Flipse, Regent of the College for Florida, served as moderator for the diagnostic-treatment conference which followed the dinner. The members of the committees were complimented by the Board of Regents for the arrangement of a splendid meeting.

The Executive Council, Board of Regents and Board of Governors of the College held meetings at the Delano Hotel, Miami Beach, on Monday, November 29. The following College officials and guests attended these meetings:

William A. Hudson, Detroit, Michigan, President

Donald R. McKay, Buffalo, New York, Chairman, Board of Regents

David H. Waterman, Knoxville, Tennessee, Chairman, Board of Governors

Arnold S. Anderson, St. Petersburg, Florida

Albert H. Andrews, Chicago, Illinois

Charles P. Bailey, Philadelphia, Pennsylvania

Otto L. Bettag, Chicago, Illinois

Charles A. Brasher, Mount Vernon, Missouri

Benjamin L. Brock, Orlando, Florida

Maurice Campagna, New Orleans, Louisiana

Duane Carr, Memphis, Tennessee

Alberto Chattas, Cordoba, Argentina

Ross K. Childerhose, Harrisburg, Pennsylvania

Dean B. Cole, Richmond, Virginia

DeWitt C. Daughtry, Miami, Florida

M. Jay Flipse, Miami, Florida

Carl H. Gellenthien, Valmora, New Mexico

Burgess L. Gordon, Philadelphia, Pennsylvania

Edward A. Greco, Portland, Maine

Alvis E. Greer, Houston, Texas

J. E. J. Harris, Albuquerque, New Mexico

Willard B. Howes, Detroit, Michigan

Chevalier L. Jackson, Philadelphia, Pennsylvania

Hollis E. Johnson, Nashville, Tennessee

Edward Lebovitz, Pittsburgh, Pennsylvania

Edwin R. Levine, Chicago, Illinois

Alexander Libow, Miami Beach, Florida

Francisco J. Menendez, Havana, Cuba

Arnold Minnig, Denver, Colorado

Herman J. Moersch, Rochester, Minnesota

Jay Arthur Myers, Minneapolis, Minnesota

J. Winthrop Peabody, Washington, D. C.

Charles K. Petter, Waukegan, Illinois

David B. Radner, Chicago, Illinois

Jack Reiss, Coral Gables, Florida

Alfred A. Richman, New York, N. Y.

William R. Rumel, Salt Lake City, Utah

James H. Stygall, Indianapolis, Indiana

Harold G. Trimble, Oakland, California

Buford H. Wardrip, San Jose, California

Murray Kornfeld, Chicago, Illinois, Executive Director

Harriet L. Kruse, Chicago, Illinois, Executive Assistant

JOINT MEETING BOARD OF REGENTS AND BOARD OF GOVERNORS

A joint meeting of the Board of Regents and Board of Governors was held at the Delano Hotel, Miami Beach, at 10:30 a.m. on Monday, November 29. Dr. David H. Waterman, Chairman of the Board of Governors, presided. The following reports were presented:

Council on Postgraduate Medical Education

Since the annual meeting of the College held in San Francisco last June, three postgraduate courses on diseases of the chest have been presented under the sponsorship of the Council on Postgraduate Medical Education of the College.

During the week October 18 through 22, the Ninth Annual Postgraduate Course was presented at the Knickerbocker Hotel, Chicago, which was attended by forty physicians. A three day postgraduate course was presented in Cleveland, Ohio, October 27-29, under the auspices of the Cleveland Clinic. This course was attended by sixty physicians. The third course was the Seventh Annual Postgraduate course presented at the Hotel New Yorker, New York City, November 8-12, at which one hundred and two physicians were registered. All of these courses were well presented and the comments received from the physicians who participated were most favorable.

The postgraduate course committee in Philadelphia has announced the completion of the program for the Eighth Annual Postgraduate Course to be held there, in cooperation with the Laennec Society of Philadelphia, March 7-11, 1955. An excellent curriculum has been prepared for this course and copies may be obtained by writing to the Executive Offices of the College in Chicago.

J. WINTHROP PEABODY, *Chairman*

Council on Undergraduate Medical Education

During the past year, the Council on Undergraduate Medical Education of the College has sponsored the publication of a number of articles on the teaching of diseases of the chest in the official journal of the College, DISEASES OF THE CHEST. We are pleased to announce that this series of articles will be continued in the coming year. Dr. Theodore H. Noehren, Vice Chairman of the Council, who contributed several articles to the series, has sent letters to many physicians engaged in teaching chest diseases, describing the program. The Council will be pleased to hear from members of the College who may have something to contribute to this phase of our program. The Council has requested the Committee on Motion Pictures to review and recommend motion pictures suitable for teaching undergraduate medical students.

With regard to the Committee on College Essay, which serves under our Council, a release concerning the 1955 Prize Essay Contest of the College has been printed and widely distributed. Members of the College who are affiliated with teaching institutions are requested to bring this Contest to the attention of medical students.

In the past, one prize of \$250.00 and a certificate of merit was awarded the winner of the Contest, with the second and third prize winners receiving appropriate certificates. At the last annual meeting of the Council it was recommended, and subsequently approved by the Board of Regents, that for the 1955 Contest there be three monetary prizes, the first prize to be \$250.00 and a certificate of merit, second prize \$100.00 and a certificate of merit, and a third prize of \$50.00 and a certificate of merit. Applications for entry in the Contest may be obtained by any student in an approved medical school by writing to the Executive Offices of the College in Chicago.

EDWARD W. HAYES, *Chairman*

Committee on Resident Fellowships

In June, 1951, with the approval of the Board of Regents of the College, the Committee on Resident Fellowships in Chest Diseases was established for the purpose of assisting qualified physicians throughout the world in receiving postgraduate training in the recent advances in the diagnosis and treatment of heart and lung diseases.

Immediately after the establishment of administrative procedures, the Committee, with the aid of the Executive Offices of the College, undertook the task of corresponding with appropriate medical institutions in the United States which maintain chest clinics or hospitals and sanatoria established for the purpose of treating tuberculosis and allied disorders. The response was gratifying as many institutions offered interesting residencies, including full maintenance in addition to a small stipend. As soon as these institutions indicated their willingness to accept Resident Fellows, officials of the College throughout the world were notified of the available opportunities which existed for postgraduate training. The officials were supplied with appropriate application forms, and within a very short period thereafter, the Committee on Resident Fellowships had the difficult task of screening the many applications that were received.

To facilitate the many problems encountered in obtaining visas, the American College of Chest Physicians applied for an Exchange Visitors Program number which, we are pleased to report, was approved by the Department of State.

During the past 3 years, the Committee on Resident Fellowships has received 130 requests for information. Ninety-eight applications were filed, of which 70 were approved by the Committee after having been previously approved by the Governors and Regents of the College in the respective countries. As of this date, 38 physicians have received or are at present receiving postgraduate training in diseases of the chest in this country. These physicians have come from the following countries: South Africa, England, Japan, India, Brazil, Spain, Panama, Nicaragua, Chile, Israel, Argentina, Formosa, Austria, Turkey, Peru, Korea, Costa Rica, the Philippines, Greece, Portugal, Italy, and Egypt.

This program has been highly commended by the Pan-American Sanitary Bureau, the United States Department of State, the American-Korean Foundation, and other government and private organizations.

A resolution was adopted by the Board of Regents at their meeting in St. Louis, Missouri on November 30, 1953, to prepare a certificate for Resident Fellows who have completed their training under the sponsorship of the Committee on Resident Fellowships. These certificates are now being awarded in accordance with this resolution.

It gives me a great deal of pleasure to announce that a special room at the Manhattan General Hospital is being set aside for the permanent New York City Headquarters of our committee. It is planned to have desks, chairs, telephone, writing materials and other conveniences at hand for the use of visiting Resident Fellows. A special plaque is also being prepared stating the purpose and sponsorship of the room, which will be installed on the door. Physicians are invited to make use of this room during their visits to New York City.

ALFRED A. RICHMAN, *Chairman*

The Regents and Governors extended their appreciation to Dr. Richman for the donation of the Headquarters Room at the Manhattan General Hospital and expressed the hope that headquarters will soon be established in other cities for this purpose.

Committee on Membership

At the time of the annual meeting in June 1954, the total membership of the College was 4787. There are now 279 applications for membership to be presented to the Board of Regents for approval at this meeting. Of this number, 140 are for Fellowship, 38 for Associate Fellowship, 79 for Associate Membership, 20 for Advancement to Fellowship and 2 for Advancement to Associate Fellowship. Of the 279 applications, there are 145 from the United States and Canada and 134 from other countries.

In addition to the above applications, there are now 62 applications filed between September 15 and November 15, 1954, which will be presented to the Board of Regents in June 1955.

CHEVALIER L. JACKSON, *Chairman*

Committee on College Chapters

During the interim between our annual and semi-annual meetings, several of our chapters have held very successful meetings.

The Rocky Mountain Chapter, which includes the states of Colorado, New Mexico, Utah and Wyoming, met at the Broadmoor Hotel on Saturday, September 25. Forty-five physicians attended and a splendid program was presented. Dr. Albert H. Andrews of Chicago and Dr. John S. Chapman of Dallas were invited as guest speakers in addition to other speakers from the chapter.

The Wisconsin Chapter met in Milwaukee on October 3 and 178 physicians attended. The well-planned scientific program was enthusiastically received.

The North Carolina Chapter met concurrently with Hurricane Hazel in Winston-Salem on October 15. In spite of the fact that Winston-Salem lay in the direct path of the hurricane, thirty physicians attended the meeting and an excellent scientific program was presented. Dr. Francis M. Woods of Brookline, Massachusetts, was the guest speaker for the evening session. The chapter deserves our congratulations for proceeding with its meeting in the face of great difficulty.

ALVIS E. GREER, *Chairman*

Dr. Hudson presented a report of the international activities of the College, including a brief resume of the excellent meetings of the World Medical Association and the International Bronchoesophagological Society which he attended in Rome and Lisbon, respectively, during the months of September and October, as an official representative of the American College of Chest physicians. Dr. Hudson stated that during his visits in Rome and Lisbon, as well as in Barcelona for the International Congress of the College, the many physicians he met expressed great interest in the Resident Fellowship program of the College and felt that this was a most worthwhile activity. The President stated that he hoped a good number of the Regents and Governors, as well as other members of the College, were planning to attend the meeting of the Cuban Chapter to be held in Havana on December 1. He pointed out that an excellent scientific program would be presented at the chapter meeting and that the officials and members of the Cuban Chapter had planned a most interesting and enjoyable social program for the College group.

Dr. Hudson announced that the Fourth International Congress on Diseases of the Chest, sponsored by the Council on International Affairs of the College, would be held in Cologne, Germany, in 1956.

Dr. Gordon, Chairman of the Committee on Scientific Program for the 21st Annual Meeting of the College, gave a brief outline of the plans for the scientific program. He announced that a number of innovations for the Atlantic City meeting had been planned, such as "Fireside Conferences," motion picture programs, adequate time for discussion from the floor, many panel discussions and summarization.

The following correspondence was read:

A letter received from Henrietta McNary, President of the American Occupational Therapy Association, concerning the first meeting of the Medical Advisory Council, to which Dr. Leonard C. Evander, Lockport, New York, has been appointed as the representative of the College.

A copy of a letter written by Dr. Edward C. Holmblad, Executive Director of the Industrial Medical Association, to Dr. Arthur Vorwald, stating that their Association will appoint a committee on rehabilitation to consult with the College committee when problems of mutual concern arise.

A vote of thanks was extended by the Regents and Governors to all of the committees responsible for the successful meeting held in Miami Beach, to the ladies committee for the splendid program they had arranged for the visiting doctors' wives and families, to Dr. Jack Reiss on the excellent program prepared for the Chest Section of the American Medical Association meeting, and to the staff of the Delano Hotel for their courtesy and cooperation during the meeting. Adjournment.

SEMI-ANNUAL MEETING BOARD OF REGENTS

The semi-annual meeting of the Board of Regents was held at 2:00 p.m. on Monday, November 29, at the Delano Hotel, Miami Beach. Dr. Donald R. McKay, Chairman of the Board, presided.

Dr. Petter, the Treasurer of the College, presented the financial report, proposed 1955 budget and the report of the Committee on Insurance, of which he serves as Chairman. Upon motion duly seconded, the above reports were approved.

The report of the Committee on Physiologic Therapy was presented by the chairman, Dr. Andrews. The committee requested that the Board of Regents of the College sponsor the newly organized American Association of Inhalational Therapists. Dr. Andrews submitted the by-laws of this society to the Board of Regents which had been prepared under the guidance of the committee. The Board was of the opinion that this association could serve a useful purpose and agreed to sponsor the society in accord with the recommendations and stipulations set forth by the Committee on Physiologic Therapy. The committee also requested permission to present its exhibit at the annual meetings of the College and the American Medical Association in Atlantic City in June, 1955. This request was approved.

Dr. John F. Briggs, St. Paul, Minnesota, was unable to be present at the meeting; Dr. Briggs' report of the Committee on Cardiovascular Disease, of which he serves as chairman, was read:

"The Committee on Cardiovascular Disease is now well organized and the chairmen of its sections on Clinical Cardiovascular Disease, Cardiovascular Surgery, Electrocardiography, Cardiovascular Physiology, Roentgenology, Pediatric Cardiology, Therapy and Rehabilitation have begun work on their various projects. We expect to receive many interesting reports on these projects at the annual meeting of the College in Atlantic City next June.

"The committee also cooperates in presenting the cardiovascular sections in our various programs and postgraduate courses and, as a result, some outstanding panel discussions and lectures have been arranged during the past year."

Dr. Bailey, chairman of the Section on Cardiovascular Surgery, reported that his section was conducting a study on cardiovascular surgery and that they hoped to report on this project at the annual meeting of the College in 1955.

In the absence of Dr. Paul H. Holinger, Chicago, Chairman of the Committee on Audiovisual Aids, Dr. Waterman, a member of the committee, presented the report. The committee requested that its name be changed to "Committee on Motion Pictures" and that a separate Committee on Audiovisual Aids be appointed, inasmuch as its activities deal only with motion pictures. Dr. Jackson

moved that the recommendation be approved and that the President appoint a Committee on Audiovisual Aids to function on an equal footing with the Committee on Motion Pictures and that those who have shown special interest in this field be called upon to form the nucleus of this committee. The motion was seconded and approved. Dr. Jackson suggested that the Committee on Audiovisual Aids not only should set up slide libraries, but also standards, qualifications, etc.

Mr. Kornfeld reported on the following College books: **NONTUBERCULOUS DISEASES OF THE CHEST**. The publishers of this new book have reported that as of this date there has been a sale of approximately 1000 copies. This indicates that the book is enjoying a good sale and orders continue to arrive at the College office, as well as at the offices of the publishers. It was further reported that Spanish translation rights have been purchased by the Editorial Bibliografica Argentina, Buenos Aires, and the Spanish version of the book will go to press in the near future. The publishers have reported that there is a steady sale of the book entitled **THE FUNDAMENTALS OF PULMONARY TUBERCULOSIS AND ITS COMPLICATIONS**, companion to the new College book, which was published in 1949. Approximately 2500 copies of this book have been sold. Two new College books are now being prepared under the chairmanship of Dr. Alfred Goldman, Los Angeles, and Dr. Coleman B. Rabin, New York City.

Dr. Trimble, Chairman of the Board of Examiners, reported that 81 candidates were examined for Fellowship in the College at the annual meeting held in San Francisco in June of 1954, and that 16 candidates were examined at the Interim Session in Miami Beach on Saturday, November 27.

Dr. McKay read the resolution concerning cancer of the lung which had been adopted by the Board of Regents at the San Francisco meeting. It was moved that the President appoint a committee of three to study the resolution and bring in a report at the next meeting of the Board concerning recommendations for changes or additions. The motion was seconded and approved.

Adjournment

COMMITTEE ON NOMINATIONS

Elections for offices expiring in June, 1955 will be held at the Ambassador Hotel, Atlantic City, June 4. Recommendations for elective offices may be addressed to the chairman of the Committee on Nominations, Dr. Jay Arthur Myers, 1316 Mayo Memorial Building, University of Minnesota, Minneapolis 14, Minnesota. Other members of the committee are Dr. Roy G. Klepser, Washington, D. C. and Dr. Howell S. Randolph, Phoenix, Arizona.

College News Notes

Dr. Andrew L. Banyai, Milwaukee, Wisconsin, Past-President of the College, will talk before the Oklahoma Academy of General Practice at its meeting in Oklahoma City on February 14 and 15. Dr. Banyai will speak on "The Diagnosis and Treatment of Pulmonary Hemorrhage" and "Modern Treatment of Cough."

Dr. James Alexander Lyon, Washington, D. C., recently returned from a lecture tour which included Portugal, France, Italy, Ireland, and Spain. While in Spain, Dr. Lyon presented a paper on "The Evaluation of Certain Arrhythmias" at the Third International Congress of the College and served on the panel discussing Cardiovascular Diseases.

Dr. Irving Mack, Chicago, Illinois, was recently promoted to Clinical Assistant Professor of Medicine at the Chicago Medical School.

College Fellows Honored

Dr. Edgar Mayer, New York City, Regent of the College, was given the Cross of the Legion of Honor of France at a reception held in his honor at the French Consulate, New York City, on January 6. The Citation stated that "Dr. Mayer, during World War I, effectively aided the United States Tuberculosis Commission to France through the medium of Dr. Alexandre Bruno, who acted as intermediary agent between the Commission and the French people. The work of this Commission led to the development of the French Saranac at Passy to which for years Dr. Mayer served in a consultant capacity and was a frequent lecturer there. Since then, Dr. Mayer has been a lecturer on occasion at the Laennec Hospital and the Hospital Boucicourt in Paris, and has aided in the publication of French contributions to medicine in American journals. He is also actively engaged in the creation of a Memorial Fund at the French Saranac in Passy to commemorate the work of the American Tuberculosis Commission that served during World War I, as well as in the interchange of medical lecturers between the United States and France."

Dr. Chevalier L. Jackson, Philadelphia, Pennsylvania, Past-President of the College, was the recipient of the First Citizens Committee Award of the Philadelphia Civic Grand Opera Company at a dinner given in his honor at the Bellevue Stratford Hotel on December 20. The citation read as follows: "On this, the occasion of your twenty-fifth year of Humanitarian and Civic Service, we, your friends and colleagues, are privileged to honor you for your illustrious record of service. We give public expression to the esteem and affection in which you are held, not only by those who have benefited directly by your efforts, but by all who know your undeviating devotion to the highest American ideals, to truth in science, and in the arts, and to service to your fellowman. We salute you as a brilliant leader in the field of medicine, as a loyal friend, as an outstanding humanitarian and an inspiring patron of the arts."

Dr. William C. Voorsanger, senior physician on the medical staff at Mount Zion Hospital, San Francisco, was awarded a certificate of merit at the hospital's annual meeting held recently in recognition of his fifty years of service there. Dr. Voorsanger was a pioneer worker in the battle against tuberculosis and, in 1905, assisted in the founding of the medical staff of the hospital; he has served on its staff since then. In recognition of Dr. Voorsanger's contributions to the hospital for over half a century, it was announced that the **William C. Voorsanger Fund** has been created to further the investigation of pulmonary diseases. During his career, Dr. Voorsanger has been chief of medical services and head of the chest service and tuberculosis clinic at the hospital. In addition he is a founder and past president of the California Tuberculosis Association and past president of the San Francisco Medical Society.

Dr. Alton Ochsner, New Orleans, Louisiana, Dr. Myron Prinzmetal, Los Angeles, California, Fellows of the College, and **Dr. Selman A. Waksman, New Brunswick, New Jersey**, a recipient of the College Medal for outstanding achievement in diseases of the chest, were among the ten scientists honored by "Modern Medicine" for distinguished achievement in medicine.

Professor Ludwig Heilmeyer, Governor of the College for Freiburg, Germany, was awarded the Carlos Finlay Medal of Cuba for distinguished contributions to medical science.

College Chapter News

CALIFORNIA CHAPTER

The annual meeting of the California Chapter will be held at the Palace Hotel, San Francisco, April 30, 1955, immediately preceding the meeting of the California Medical Association, May 1-5.

Out-of-town speakers who wish to submit papers for presentation at the chapter meeting are requested to communicate with Dr. Marvin S. Harris, Secretary, 6317 Wilshire Boulevard, Los Angeles, California.

CUBAN CHAPTER MEETING

A meeting of the Cuban Chapter of the College was held at the Hospital Curie in Havana on Wednesday, December 1, 1954. Forty-two members of the College and their wives who had attended the Interim Session of the College in Miami Beach, flew to Havana on Tuesday, November 30, to participate in the meeting. A friendly welcome was accorded the College group upon their arrival at the Havana airport, by the officials of the chapter. A bus was waiting at the airport to take the group to the Hotel Nacional.

The Cuban Medical Association gave a reception and luncheon for the group on Wednesday, December 1, at the headquarters building of the Association. The presidents of both the Cuban and the Havana Medical Associations were present and welcomed the College members in a brief ceremony held in the private auditorium of the Association. The President of the College, Dr. William A. Hudson, responded with an expression of sincere appreciation of the cordial hospitality extended to the College visitors by their Cuban colleagues. After lunch, a bus was waiting to take the group on a tour of Havana. A cocktail party was also given for the College members at the Bacardi Bar in downtown Havana. The scientific session was held that evening at the Hospital Curie.

Dr. Antonio Navarrete of Havana, Regent of the College for Cuba, and the other officials of the Cuban Chapter, Dr. Teodosio Valledor, Governor, Dr. H. Anido Fraguio, President, and Dr. Antonio Rodriguez Diaz, past-president, deserve the highest praise for arranging a splendid program for the College members from the United States, who will long remember their enjoyable visit to Havana. A special vote of thanks was extended to Dr. Manuel Conde, a Fellow of the College and President of the Cuban Medical Association, for their hospitality.

PENNSYLVANIA CHAPTER

The Pennsylvania Chapter will present a diagnostic x-ray conference on Monday evening, March 7, at the Bellevue-Stratford Hotel, Philadelphia, following the banquet of the 8th Annual Philadelphia Postgraduate Course on Diseases of the Chest, which will be held March 7-11.

ANNOUNCEMENTS

Groningen University (Holland) will sponsor its Fifth Postgraduate Course of Thoracic Clinical Science and Surgery, May 23-June 13, 1955. The World Health Organization has invited its member states to send participants to the course and has allocated funds for their individual fellowship donations. Prof. L. D. Eerland, Regent of the College for Holland, is Chairman of the course and Prof. R. Brinkman is Secretary.

The annual meeting of the Aero Medical Association, under the Presidency of Brigadier General Otis O. Benson, Jr., will be held at the Hotel Statler, Washington, D. C., March 21-23, 1955.

The Los Angeles County Tuberculosis and Health Association and the Los Angeles Trudeau Society will sponsor the 5th Pulmonary Diseases Symposium February 4, 5, 6, 1955.

Obituary

MAZZINI BUENO

1889-1954



The world has just lost a teacher, author and pioneer in the field of tuberculosis. Unusual ability, a straightforward manner, and a dedication to the sick, combined with kindness and a cheerful heart, made Dr. Bueno a great physician. He graduated from the University of Brazil—then the University of Rio de Janeiro—in December, 1910. He interned at Santa Casa de Misericórdia in the same city. He was appointed Assistant Professor of Medicine and served under the great Brazilian physician, Miguel Pereira, from 1911 to 1917. As early as 1914, he instituted pneumothorax therapy, the first of such treatment to be given in a medical school and community hospital in Brazil. In 1923, he was co-founder and Professor of Medical Diagnosis and Tuberculosis in the Fluminense Medical School of the University of the State of Rio de Janeiro. He was the first Brazilian physician to be placed in charge

of a pavillion for tuberculosis patients. This was in the Hospital Sao Sebastiao, Rio de Janeiro, in 1918. In 1922, the Brazilian Department of Public Health asked him to take charge of pneumothorax therapy. While associated with that department, he had great influence over many physicians who were then prominent in this field in Brazil: Dr. Ary Miranda, Dr. Genesio Pitanga, Dr. Alberto Renzo and the late Dr. Alexander Stockler. Dr. Bueno was a contemporary of Dr. Manuel de Abreu and gave support to this important and world-renowned work on photoroentgenography.

In 1924, Dr. Bueno published his first book concerning collapse therapy. In addition to the books he wrote on diseases of the chest, Dr. Bueno published several scientific treatises. One important paper entitled, "Changes of Volume of Pulmonary Cavities Due to Bronchial Disturbances," was published in 1932. Dr. Bueno was a co-founder of the Brazilian Tuberculosis Society. His associate members recognized his great contributions by electing him as President, both of this Society and the Central Brazilian Chapter of the American College of Chest Physicians.

Over one thousand people attended his Mass—a traditional ceremony in Brazil. His wife, Laura, and six children, including two physicians—Marcio and Roberto—survive him.

The memory of Dr. Bueno will be perpetuated forever by his writings and in the good works of many dedicated students.

RICHARD H. OVERHOLT, M.D.

Plan NOW
to Attend!

*21st Annual
Meeting*

AMERICAN COLLEGE
OF
CHEST PHYSICIANS

Ambassador Hotel
Atlantic City, New Jersey
June 2 through 5, 1955

* * *

Panel Discussions

Round Table Luncheons

Fireside Conferences

Motion Pictures

Diagnostic-Treatment Conference
Seminars

Convocation

Annual President's Banquet

Fellowship Hour

Music and Dancing

Ladies Activities

and many other innovations

for details see page 233

for hotel reservation form,
see page xvi

* * *

*104th Annual
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CALENDAR OF EVENTS

NATIONAL AND INTERNATIONAL MEETINGS

21st Annual Meeting, American College of Chest Physicians
Ambassador Hotel, Atlantic City, New Jersey, June 2-5, 1955

Fourth International Congress on Diseases of the Chest
Council on International Affairs, American College of Chest Physicians
Cologne, Germany, 1956

POSTGRADUATE COURSES

8th Annual Postgraduate Course on Diseases of the Chest
Bellevue-Stratford Hotel, Philadelphia, March 7-11, 1955

2nd New Jersey Postgraduate Course
Essex House Hotel, Newark, March 9, 16, 23, 30, 1955
(four consecutive Wednesdays)

CHAPTER MEETINGS

Clinical Session, New York State Chapter
Hotel New Yorker, New York City, February 17, 1955
Missouri Chapter, Kansas City, March 27, 1955
Florida Chapter, St. Petersburg, April 3, 1955
Tennessee Chapter, Chattanooga, April 12, 1955
New Jersey Chapter, Atlantic City, April 18, 1955
Ohio Chapter, Cincinnati, April 20, 1955
Texas Chapter, Fort Worth, April 24, 1955
California Chapter, San Francisco, April 30, 1955

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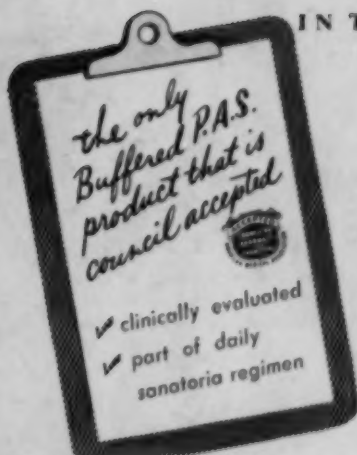
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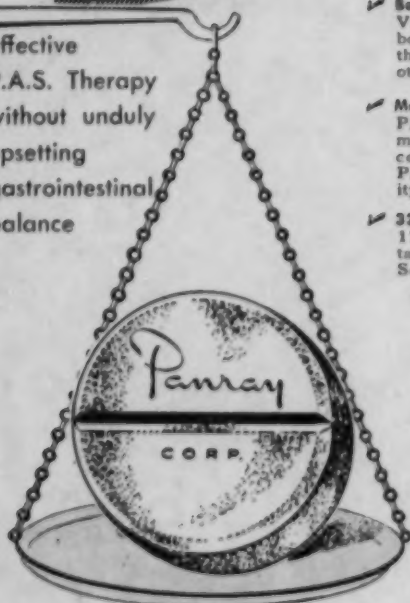
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References

- (1) V.A. Quarterly Prog. Report, April '53
- (2) V.A. Quarterly Prog. Report, Oct. '54

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